Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING
PLATING · ANODIZING · RUST PROOFING · LACQUERING & ENAMELING

NOVEMBER, 1961

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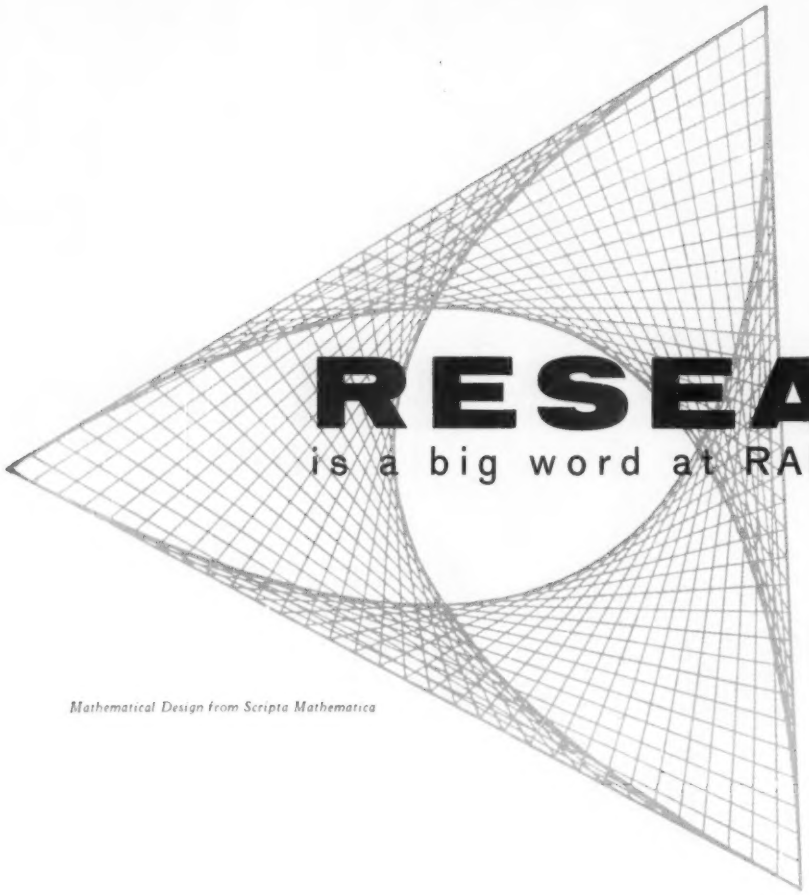
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Read and pass on—

PLATING POWER BY DC POWER SPECIALISTS



RESEARCH

is a big word at RAPID ELECTRIC

Mathematical Design from Scripta Mathematica



Our new Brookfield plant exemplifies our continuing research and development program. Here, complete laboratory and test facilities help initiate new designs, and controls for greater rectifier economy and efficiency. Those savings are passed directly on to you—the user.

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PLANTS: (4) NEW YORK, N.Y. • GRAYSBRIDGE ROAD, BROOKFIELD, CONN.

NEW 'ENPLATE' chemical plating baths plate without electric current

CHEMICAL PLATING

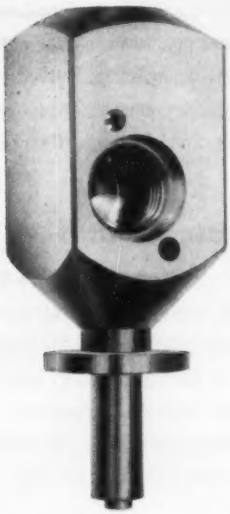


PLATE HARD NICKEL
OF UNIFORM THICKNESS ALL OVER

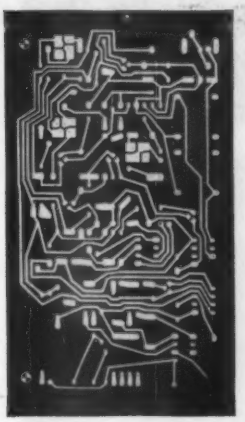


PLATE COPPER ON PRINTED
CIRCUITS, PLASTICS, CERAMICS, METALS

COMPLETE 'ENPLATE' PROCESSES AVAILABLE FOR PLATING ON MORE THAN 50 MATERIALS—FROM ALUMINUM TO VINYL

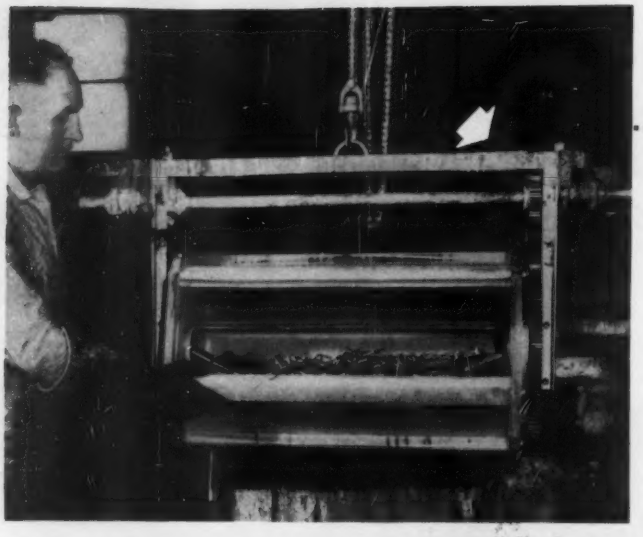
Plastics, printed circuits, rubber, glass, ceramics, ferrites, other non-conductors and semi-conductors, metals. These are among more than 50 materials you can now plate efficiently at low cost with Enthone's new line of 'Enplate' electroless nickel, copper and silver plating products and processes.

For example, 'Enplate' Ni-410 deposits a hard, wear-resistant, nickel-phosphorous coating of uniform thickness on the most complex parts. Corrosion resistance is better than electroplated nickel. Brass housing illustrated above has same thickness of 'Enplate' nickel in blind holes and screw threads as on outer surfaces and edges. 'Enplate' CU-400 is excellent for rapid application of a thin film of copper on non-conductor surfaces. Plastic surfaces, such as thru-holes in printed circuit board shown, can be made conductive for subsquent electro-plating.

'Enplate' chemical plating baths are highly purified, ready-to-use liquid concentrates. Just add to water to make instantly usable chemical plating solutions. For guidance on your best chemical plating cycle and on proper cleaning and activation procedures, write today for your copy of the new 'Enplate' brochure. Enthone Incorporated, 442 Elm Street, New Haven 8, Conn.

ANOTHER PRODUCT OF Enthonics RESEARCH

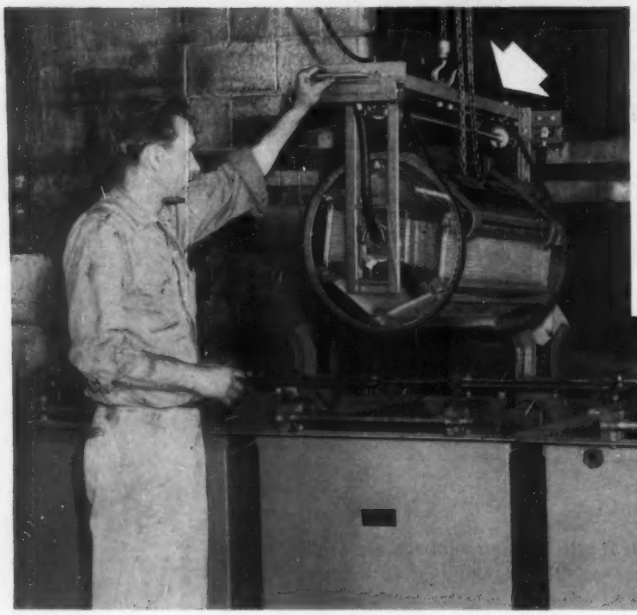
ENTHONE *A Subsidiary of American Smelting and Refining Company* ASARCO



Big Moments in Plating!

World's Toughest Gear-Drive

Another Singleton development — **"Seilon" Gears!** First in operation at **Linndale Plating,** Cleveland (left). The only gear drives for 100% universal barrel plating — in **all** solutions to 220°F. (acid, alkali), for all makes, types, sizes, ages of equipment. Replace **your** old gears with Singleton "Seilons" — outperform, outlast all others — compatible with solutions many other synthetic or metal gears can't tolerate. Send for tech-data, prices.



World's Fastest Barrel Line

Another Singleton development — **"Low-Boy" Superstructure!** First in operation at **Progressive Plating,** Elyria, Ohio (left). Lowest silhouette for fastest, easiest barrel operations in plating. Requires less head room, shorter lifts; saves hoist-time, manhours. Streamline **your** barrel lines with "Low-Boys" — fit any make, type, size, age of equipment. Send for tech-data, prices.

Barrel Platers Beat Own Output Records, Cut Expenses with New Singleton Developments

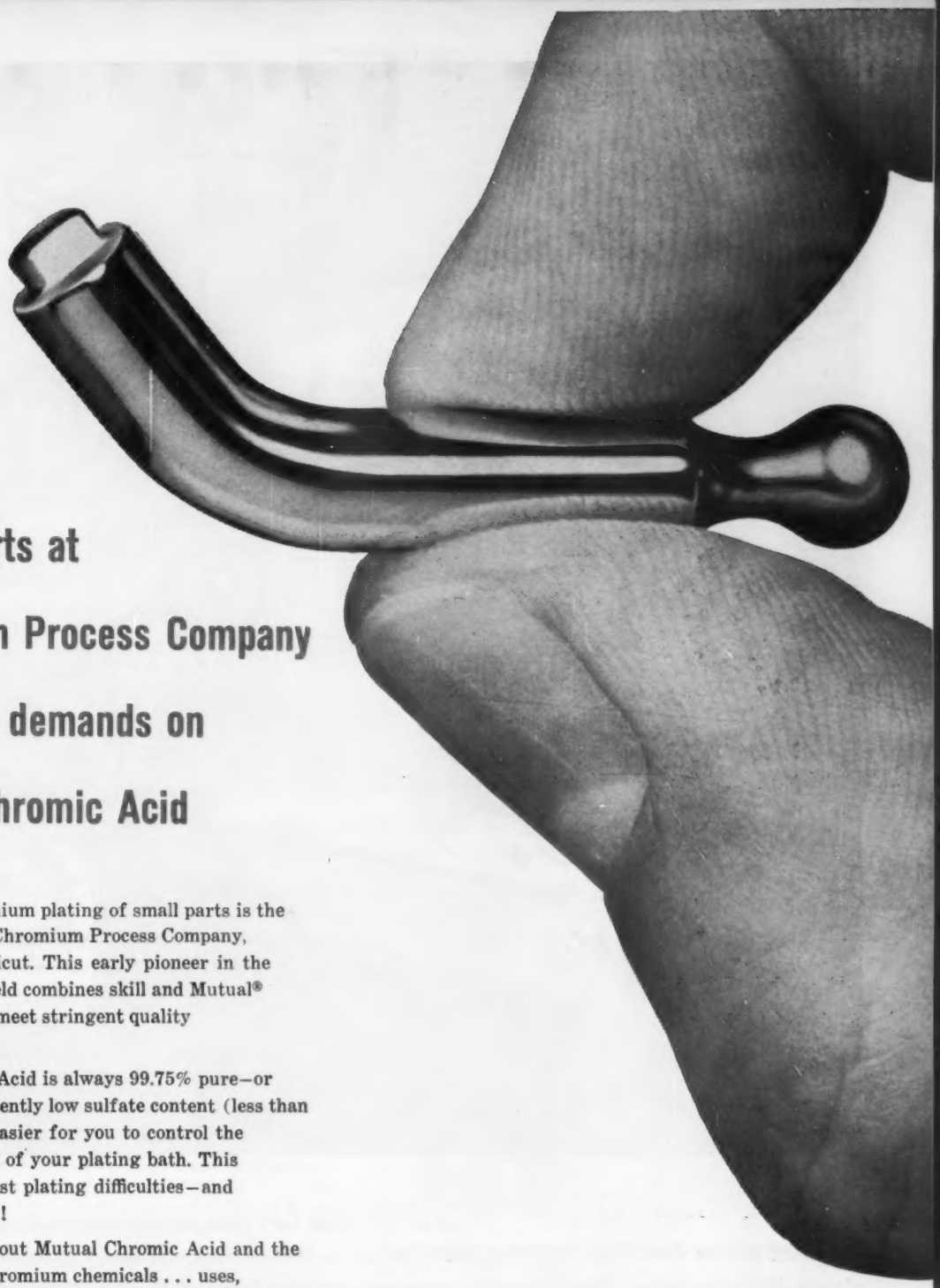
"Biggest performance boost yet," is report of first barrel platers to use newest Singleton equipment. Those who follow report the same. **Performance** makes the difference. Output and quality win against time and costs. Every major plating barrel equipment advance in 20 years is a Singleton development. That's why Singleton-equipped barrel platers lead the "pack" in production, quality . . . and **profits!**

Get the facts on **Singleton Replacement Cylinders** made of the toughest "synthetics" to fit all makes, types, sizes, ages of superstructures. **Singleton Cylinder-Superstructure Units** to fit existing installations — any make, type, size, age. **Singleton "Cogged-V-Belt" Drive (or gear) Plating Barrels,** single or multi-station, allied equipment and accessories. These and others are featured in the new Singleton General Bulletin. Includes data, prices, etc. Send for it. **All protected by Singleton's U. S. Pat. 2,886,505.**

Singleton

Please contact **The Singleton Co.,** 11720 Berea Rd., Cleveland 11, Ohio.
Telephone: CLearwater 1-5580.

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Small parts at Chromium Process Company make big demands on Mutual Chromic Acid

Decorative chromium plating of small parts is the specialty of The Chromium Process Company, Shelton, Connecticut. This early pioneer in the custom plating field combines skill and Mutual® Chromic Acid to meet stringent quality requirements.

Mutual Chromic Acid is always 99.75% pure—or better. Its consistently low sulfate content (less than 0.1%) makes it easier for you to control the acid-sulfate ratio of your plating bath. This safeguards against plating difficulties—and expensive rejects!

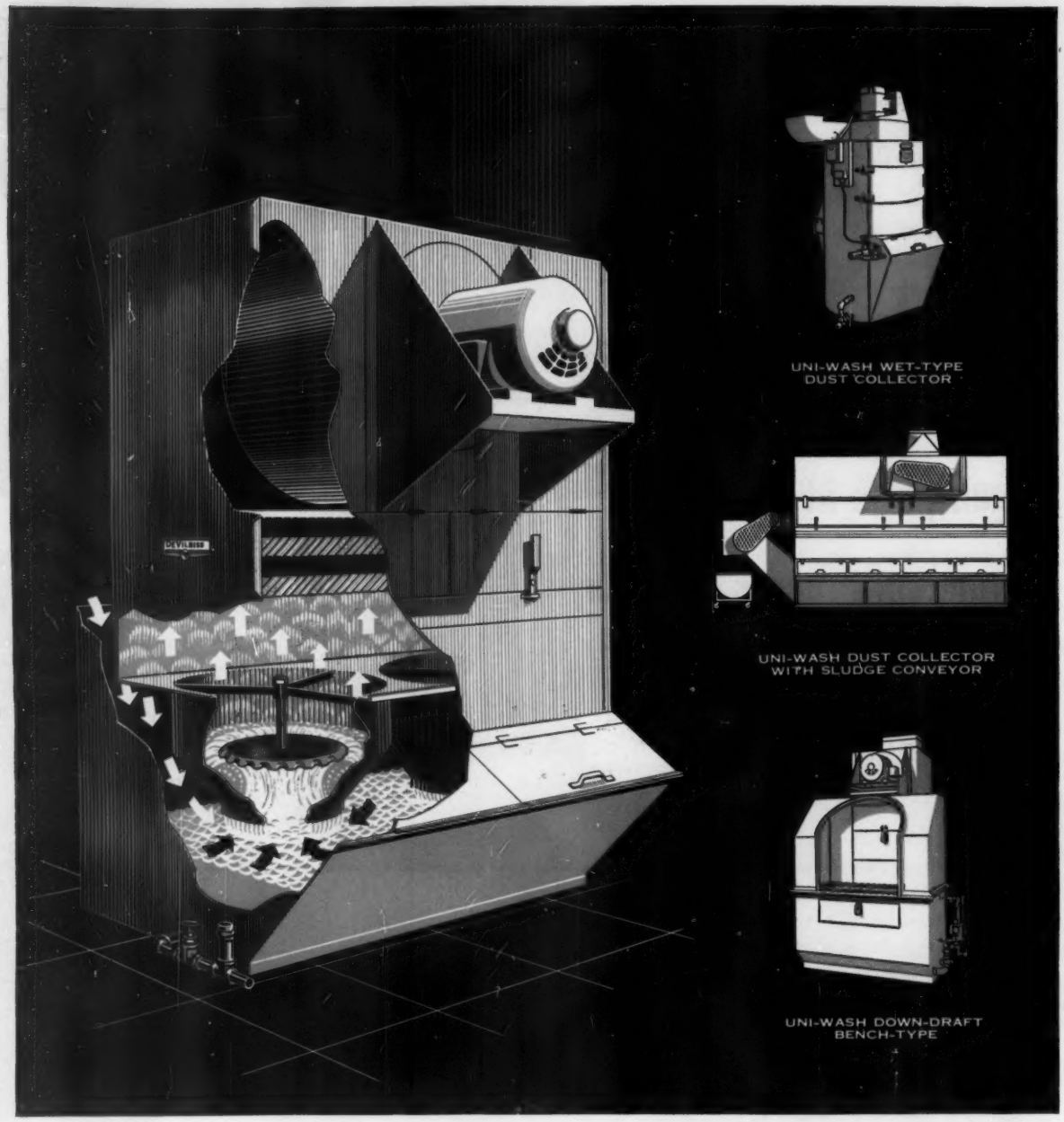
To learn more about Mutual Chromic Acid and the Mutual line of chromium chemicals . . . uses, properties and comprehensive technical data . . . write for your free copy of Solvay's 80-page Technical Bulletin, "Chromium Chemicals." Our Technical Service Staff will also be happy to answer your questions. State whether you would like to have a representative call.

SOLVAY® PRODUCTS FOR PLATERS

Mutual Chromic Acid • Solvay Caustic Soda • Solvay Hydrogen Peroxide • Solvay Methylene Chloride • Mutual Sodium Chromate • Mutual Sodium Bichromate • Solvay Soda Ash

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dust collectors from DeVilbiss are your answer if you have a problem involving process dust. This Uni-Wash wet-type unit washes, scrubs, and fogs contaminants from the air stream during processing. Other types remove vapors, corrosive fumes, chips, dirt, sticky mists. DeVilbiss can build complete systems to your specifications—or furnish standard units ready for bolting to your floor.

Talk to DeVilbiss about all your process dust collection problems

FOR TOTAL SERVICE, CALL
DEVILBISS

THE DeVILBISS COMPANY, Toledo 1, Ohio. Also Barrie, Ontario; London, England; São Paulo, Brazil. Branch offices in principal cities.

ISOBRITE® 354 Zinc Plating Brightener



Unretouched photograph illustrates Isobrite 354's ability to give a sparkling finish to deep recesses and unusual shapes as well as flat surfaces.

Why does Isobrite 354 give you the most for your money? Let's see:

VERSATILITY—Isobrite 354 works at top efficiency over the lowest to highest current density ranges, giving you an extra bright finish in either rack or barrel operations.

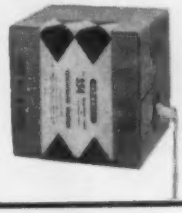
ECONOMY—You get from 85,000 to 125,000 ampere/hours per gallon brightening life from Isobrite 354, depending on the degree of brightness you require. (And, if you're after a *permanent* full bright effect, use Iridite as a final finishing process.)

THROWING POWER—It's the ability to get into recesses—deep, narrow recesses—as well as giving a high luster on flat, easily accessible surfaces — that makes Isobrite 354 the right brightener for you. Flat, convex, concave surfaces—turns, twists or loops — Isobrite 354 covers any surface.

STABILITY—Isobrite 354 has exceptional high temperature stability . . . and it bounces right back to full effectiveness even after long, weekend shutdowns.

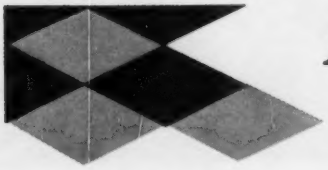
Call your Allied Field Engineer for complete information on Isobrite 354 or other Isobrite brighteners for zinc, cadmium and copper. He's listed in the Yellow Pages under "Plating Supplies". Or, write direct for technical data. On the West Coast, write or call the L. H. Butcher Co., licensee.

New Isobrite Pak with Flex-Spout gives pouring, storing and handling ease



Unscrew the cap and pop out the spout for non-drip pouring and accurate measuring. Pop the spout back in for safe, convenient handling. Spout, polyethylene container all packaged in a square, lightweight cardboard container to make storing and inventory easy.

FREE BOOKLET—"Practical Cyanide Zinc Plating". Gives practical information for purchasers and users of zinc plating processes. Tells how to produce quality work efficiently and economically. Direct requests to Department 2 of address below.



Allied Research Products, Inc.

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SHOP BULLETIN F60-17
Discontinuation
Polishing & Buffing Operations
August 8, 1960
Effective immediately all polishing and buffing operations on AMES MAID items, prior to plating, are to be discontinued.
C.D. Memel

Ames said goodbye completely to polishing and buffing when SUPERLUME came along

Ray Schlotterbeck exhibits a few Ames products plated with Superlume. Above him, another testimonial to Superlume's superiority . . . Shop Bulletin F60-17.



Reports RAY SCHLOTTERBECK,
Plating Superintendent for the world's largest maker of Shovels and Garden Tools (since 1774), as well as famous AMES MAID and AMES AIRE Tubular Furniture.

One month after Superlume bright nickel bath went into operation at O. Ames Company, Parkersburg, W. Va., the official bulletin shown declared *all* polishing and buffing there no longer necessary.

Ames had been polishing 5000-6500 parts a day, first switched to Superlume just to give its products added eye-appeal. When Superlume produced a greater depth of color *without* polishing than previous baths gave *with*, Ames got a tremendous bonus: *A reduction in its over-all finishing costs of 10 to 12%.*

"I never saw a bath that levels better," says Ray Schlotterbeck, "nor one that throws or brightens better, either." And Ames sales people add, "Our product quality was never higher."

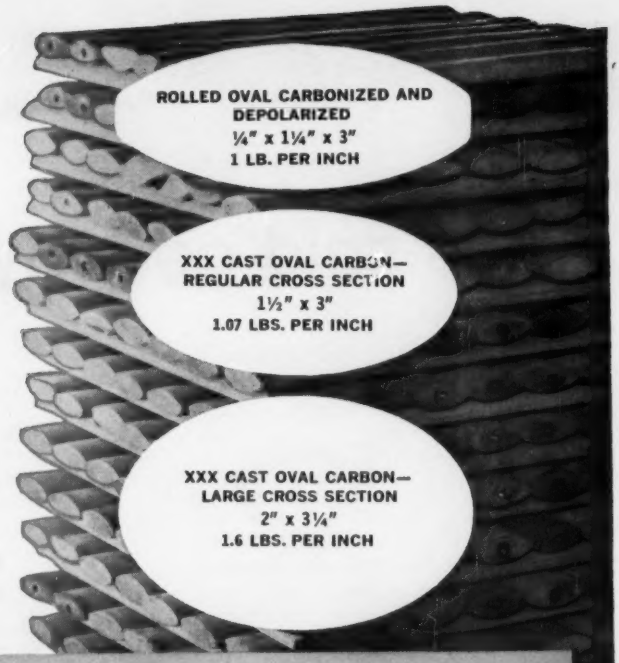
Results like these are common with Superlume. Ask H-VW-M for full details.

H-VW-M

Progress in metalfinishing through advanced processes • equipment

Hanson-Van Winkle-Munning Company, Matawan, New Jersey
Offices in Principal Cities
Alert Supply Company is H-VW-M in the West
Los Angeles • San Francisco

Many reasons for ordering HARSHAW QUALITY NICKEL ANODES

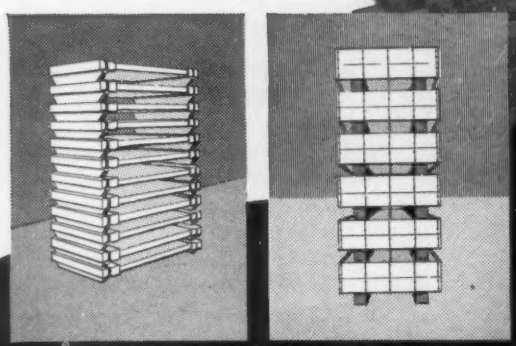


ROLLED OVAL CARBONIZED AND DEPOLARIZED
¼" x 1¼" x 3"
1 LB. PER INCH

XXX CAST OVAL CARBON—REGULAR CROSS SECTION
1½" x 3"
1.07 LBS. PER INCH

XXX CAST OVAL CARBON—LARGE CROSS SECTION
2" x 3¼"
1.6 LBS. PER INCH

* Consistent guaranteed quality * Cut to any length
* 5 shapes to choose from * High purity
* Drilled and tapped to your specs
* Packaged on Harshaw's patented "ANOPAX" skids
* Anodes arrive clean and easy to handle
* Cast in 3 shapes from pure electro sheet or from your scrap * Stocks close to you



Sketches illustrate "Anopax" stacking.

ROLLED FLAT CARBONIZED—LARGE CROSS SECTION
1¼" x 4"
1.5 LBS. PER INCH

XXX CAST RECTANGULAR CARBON—LARGE CROSS SECTION
1½" x 3⅛"
1.5 LBS. PER INCH

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THE HARSHAW CHEMICAL CO.

1945 East 97th Street — HARSHAW — Cleveland 6, Ohio
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STONE AGE or JET AGE

how does your chrome plating stack up?

You can keep your chrome-plating process in step with today — with Diamond CPA 1800®.

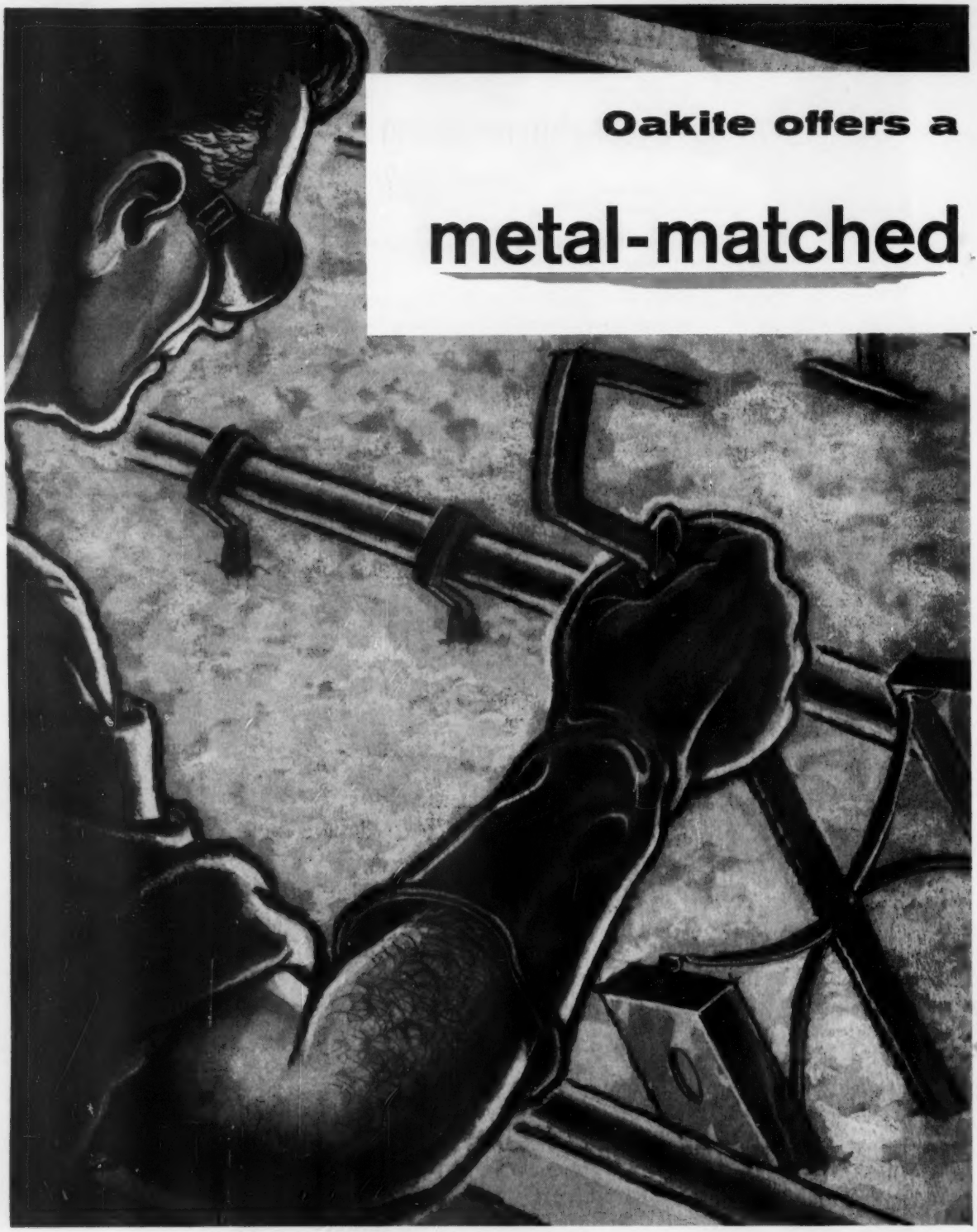
For example: The CPA 1800 process is now being used in advanced jet engine experimentation — meeting the severest tests for corrosion and abrasion-resistance tolerances ever imposed on high-pressure seals.

This same jet-proven additive is available to you and to your chrome-plate source. To increase plating speed and covering power. To allow a broader operating range. To simplify anoding and produce a brighter, harder coating. To improve the metallurgical characteristics of chromium plate.

In short: Diamond CPA 1800 can cut your unit costs and save you money. Diamond developed it. Your Diamond CPA 1800 Distributor can supply it where and when you need it. For further information write or call Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio.

Diamond Chemicals





Oakite offers a

metal-matched

For the complete answer to better plating

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 FIELD SERVICE MEN • OVER 160 MATERIALS

complete line of materials for

ELECTROCLEANING

. . . improves the cleaning
. . . improves the plated-work

There are Oakite electrocleaners to meet the special requirements of all the usual basis metals being plated, and the soils generally left on the parts during fabrication operations.

Matched to the work, each electrocleaner does the job with remarkable efficiency and surprising economy. Service results show it. Users find that solutions have long life. Operating problems are at a minimum. Most importantly, a metal-matched electrocleaner assures a brighter and perfectly adhering plated finish.

TWO-IN-ONE CLEANING OF STEEL

Oakite 190 does double duty. A *chelated* detergent for anodic or periodic reverse current use, it removes smut, heat scale and rust bloom that normally need extra treatment. At the same time, its powerful alkaline detergency gets rid of oil films and shop soil. Such cleaning insures fewer plating rejects, and can in many cases eliminate an entire operating step.

CLEANING OF COPPER WITHOUT TARNISH

Oakite 191 gives fast, thorough electrocleaning action on brass and other copper alloys, while protecting against tarnish . . . especially in reverse current cleaning. Shop soils, smuts, light buffing compounds disappear quickly. For heavily soiled parts, the solution also serves as a non-tarnishing pre-soak.

FEWER REJECTS FOR ZINC DIE CASTINGS

Oakite 195 electrocleans without etching or discoloring buffed zinc base die castings . . . also works well with lead, brittania metal, steel and brass. Used with direct, reverse or periodic reverse current, it removes soils safely yet thoroughly . . . assuring a brighter chromium luster. Many users of this new cleaner have reported no rejects due to poor electrocleaning for the first time in their experience.

Ask Oakite to detail what's in store for you when you match these materials to your work. Write Oakite Products, Inc., 40 Rector Street, New York 6, N. Y.

it PAYS to ask . . . **OAKITE**

over 50 *Est. 1909* SCIENCE *years' leadership in industrial cleaning*



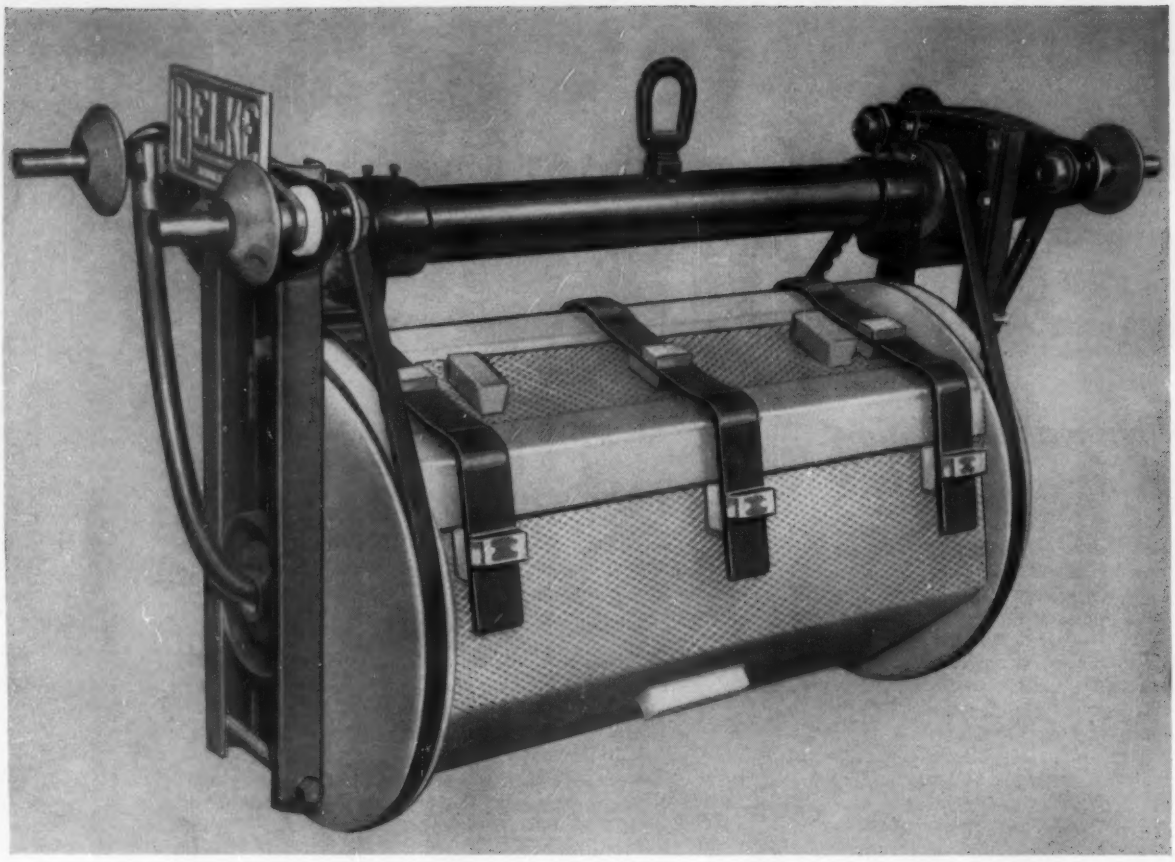
Media-matched compounds offer better barrel finishing

A good match of compound to the job means clean and efficient media . . . faster cutting down, deburring . . . and proper lubrication for smooth burnishing. Oakite can match your needs with compounds for fine finishes, tight tolerances - for hard or soft water. Send for Bulletin F-9339.



Stop spotting, add sparkle with Oakite Rinsite®

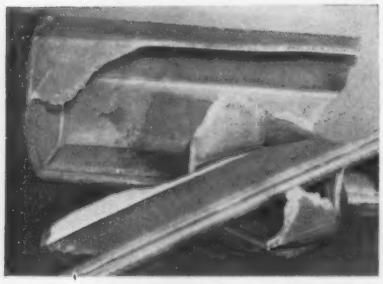
After plating and barrel finishing, adding a little Rinsite to rinse water, helps cut water spotting and staining. It "thins" the rinse, makes it drain faster. It also leaves a thin, non-oily, invisible film that adds sparkle and indoor rust protection to plated parts. Send for Bulletin F-9822.



above cylinder equipped with NEW no metal, all plastic cover clamp.

BELKE Plating Cylinders of Polypropylene

- higher temperature resistance
- wider chemical resistance
- great impact strength
- much longer service life
- greatly reduced maintenance
- cost no more than regular cylinders



This can never happen to a BELKE polypropylene cylinder

This wondrous, chemically inert Polypropylene withstands all plating solutions at temperatures to 200°F — also withstands knocks and blows that break cylinders of other materials.

One-piece molded construction with fitted and welded end pieces gives maximum rigidity — eliminates panels, ribs and tie-rods.

Smooth, rounded inside corners make unloading easy — leave nothing to trap and hold small pieces.

Re-inforced door openings add enduring ruggedness — eliminate all tendency to warp or spring under heavy loads.

Made in belt and gear driven types — all sizes from the largest regulars to 6x12 portables. Available as replacements for all BELKE sizes.

Send specifications for quotations.

Belke MANUFACTURING COMPANY
947 N. Cicero Ave., Chicago 51, Ill.
EVERYTHING FOR PLATING PLANTS
TRADE MARK

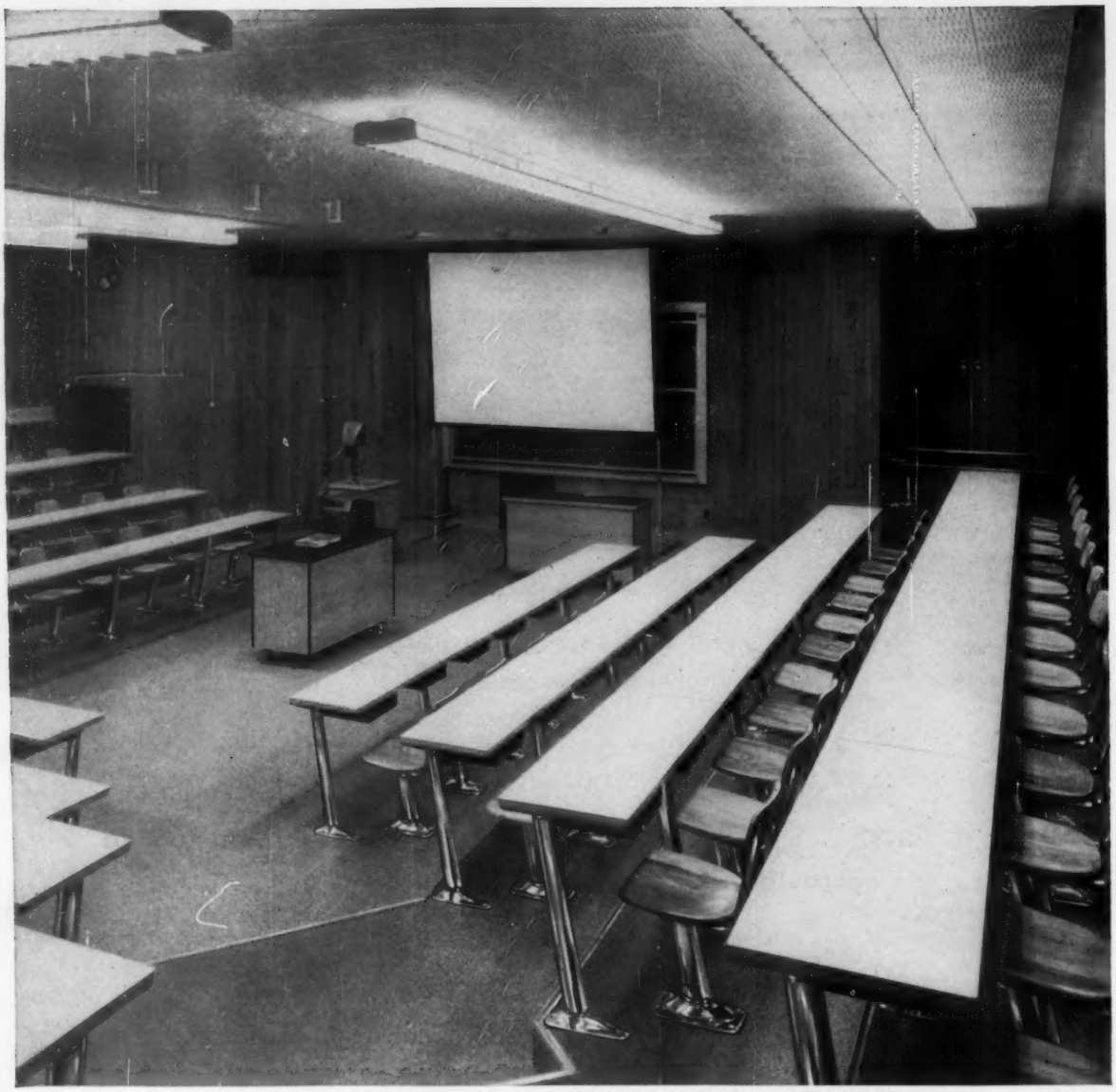
HARSHAW
Perflow-Perglow
DUPLEX NICKEL

STILL the most outstanding--by far

* well over 1 million gallons in use—and STILL increasing
* overwhelmingly STILL the most widely used double nickel process
* STILL the most highly levelling with unexcelled corrosion resistance
* STILL the most successful duplex process on both steel and zinc die-castings

The outstanding leadership of Harshaw Perflow-Perglow can be explained. Call us. Perhaps you should be using it.





Photographed at the Wayland High School, Wayland, Mass. School furniture by the Heywood-Wakefield Company, Gardner, Mass.

The modern schoolroom has Nickel-Chrome Plated furniture

This lecture hall is the latest in modern schoolroom design. It seats 150 in a step-down amphitheatre shape for complete visibility from every seat . . . has the newest audio-visual aids, including a projector for showing films and live demonstrations from the school's TV studio.

Adding to the room's modern look is row upon row of lustrous Nickel-Chrome Plated furniture. This tough, durable finish stands up to the scuffing of feet, pens, pencils, pins and things that mar the good looks of school desks and chairs . . . enables the furniture to take the worst kind of punishment without losing that lasting brightness.

Nickel-Chrome Plating works so well—it gives designers true flexibility in selecting basis materials . . . it gives metal finishers a coating system that protects the product for years of rugged wear.

When your product demands call for superior wear resistance and long-lasting beauty, consider the advantages of versatile Nickel-Chrome Plating.

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street INCO New York 5, N. Y.

INCO NICKEL MAKES PLATING PERFORM BETTER LONGER

DAW JUNIOR

FULLY AUTOMATIC PLATING MACHINE

(Furnished For Rack Or Finger Type Plating)

Unloads Automatically Only plating machine in the industry that unloads racks or fingers without operator's attention.

Selective Cycling Automatic by-passing of tanks—or any combination of cycles—can be arranged on the Daw Jr.

Minimum Dragout Cam lift, between tank transfers, tilts work above horizontal which practically eliminates dragout regardless of workpiece shape or size.

Machine Modifies Easily Quick removal or addition of tank-and-carrier sections shortens or lengthens machine to suit any need.

Installs Anywhere Daw Junior fits in any unusual or limited floor space, and where headroom is lowest.

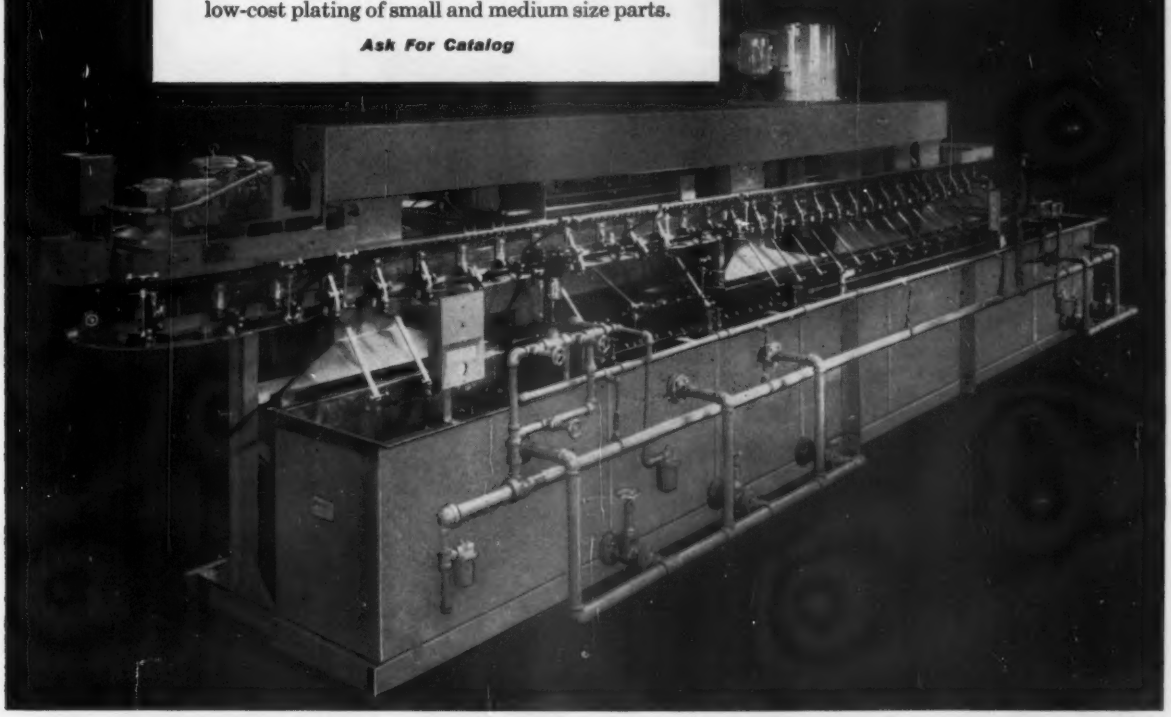
Fast And Economical The most versatile, most efficient machine ever designed for fast, low-cost plating of small and medium size parts.

Ask For Catalog

AUTOMATIC UNLOADING

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ATTACH TO COMPANY LETTERHEAD

Send complete information on Daw Jr. Automatic Plating Machine

Name.....

Title.....



Get brilliant, blue-white zinc plating—without bright dipping!

Du Pont "Zin-O-Lyte"* brighteners give you superior cyanide zinc plating . . . with no bright dipping required. You get brilliant blue-white, rust-resistant deposits directly from the plating bath over a wide range of current densities. Extra rinse and bright dip tanks aren't needed . . . an important space-saving feature.

Two "Zin-O-Lyte" brighteners are available:

- "Zin-O-Lyte"—widely used powder form. Available in two formulations, one for barrel plating and one for still plating.
- "Zin-O-Lyte" Special—a low-cost formulation designed for barrel plating.

For additional information on these products and demonstrations of "Zin-O-Lyte" quality and performance, contact your Du Pont distributor or nearest District Office. Du Pont Electrochemicals Department, Wilmington 98, Delaware.

DU PONT ZIN-O-LYTE®

zinc plating chemicals

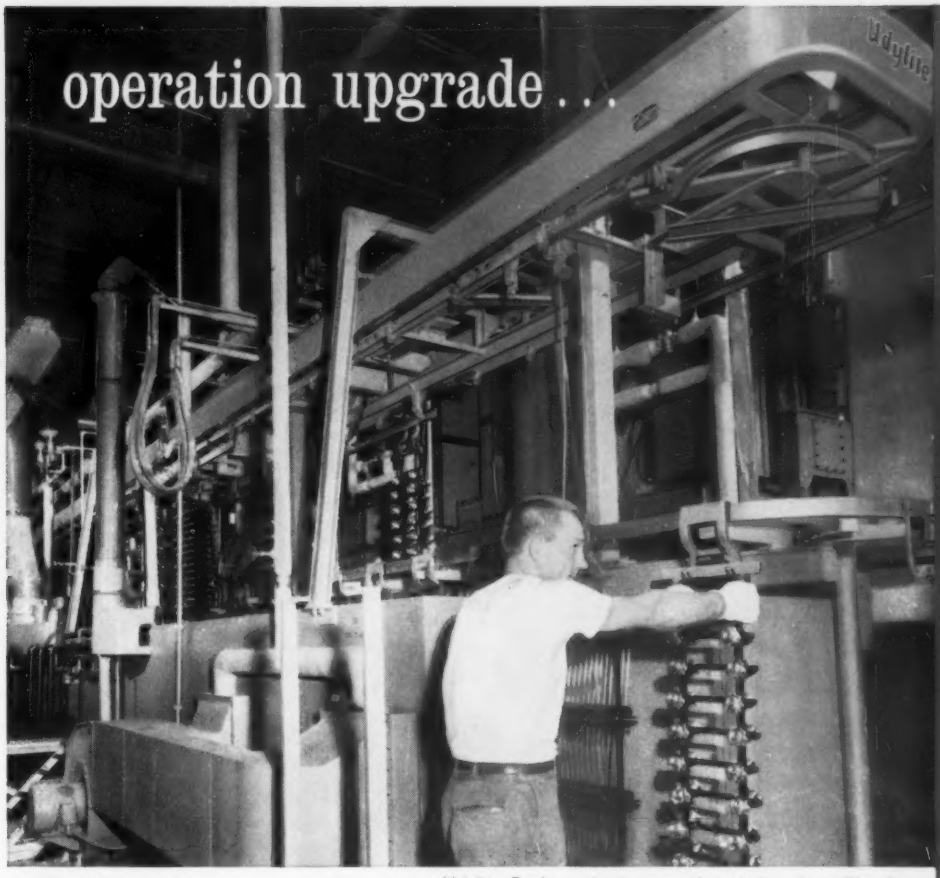
*Reg. trademark for DU PONT zinc plating chemicals.

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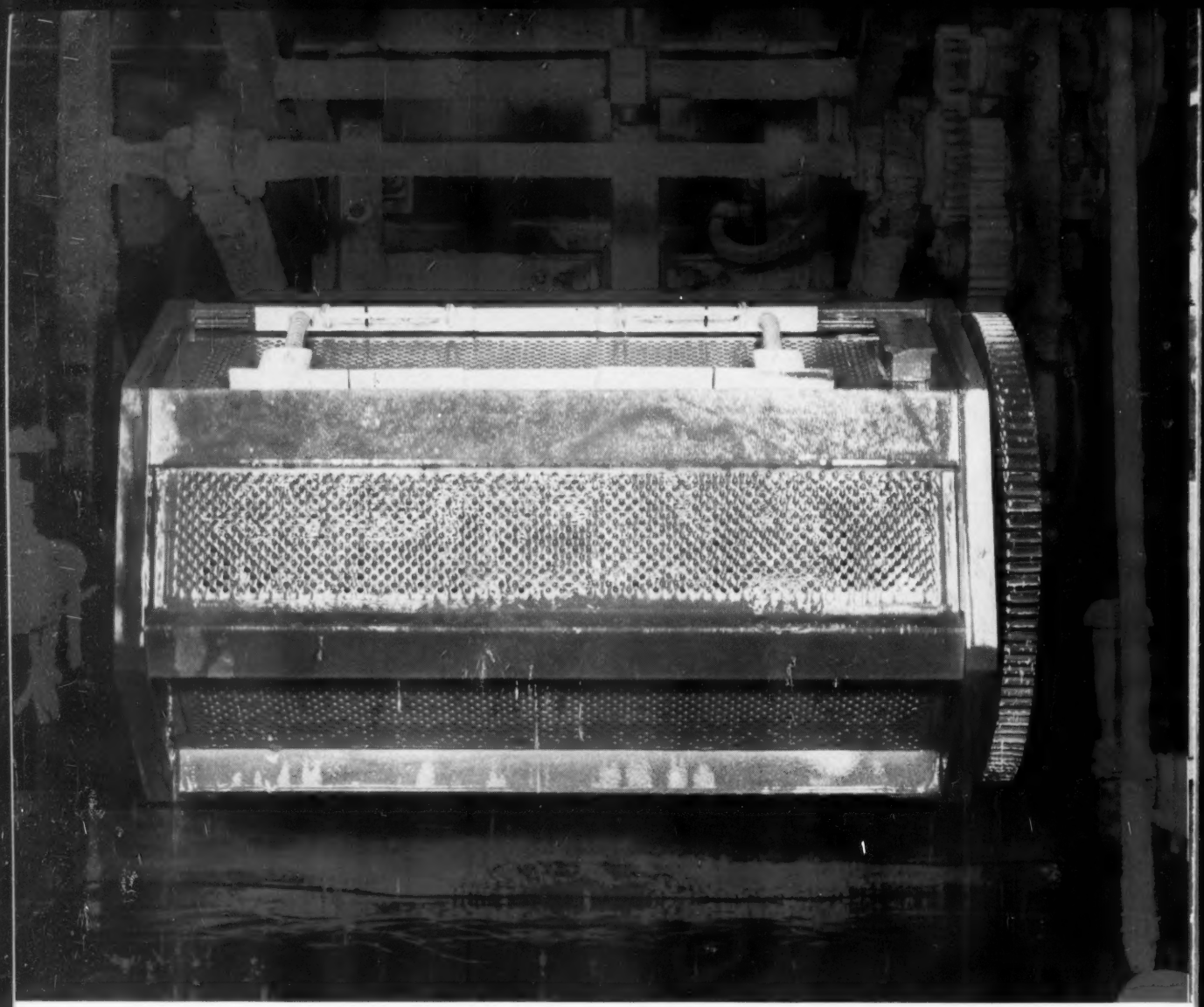
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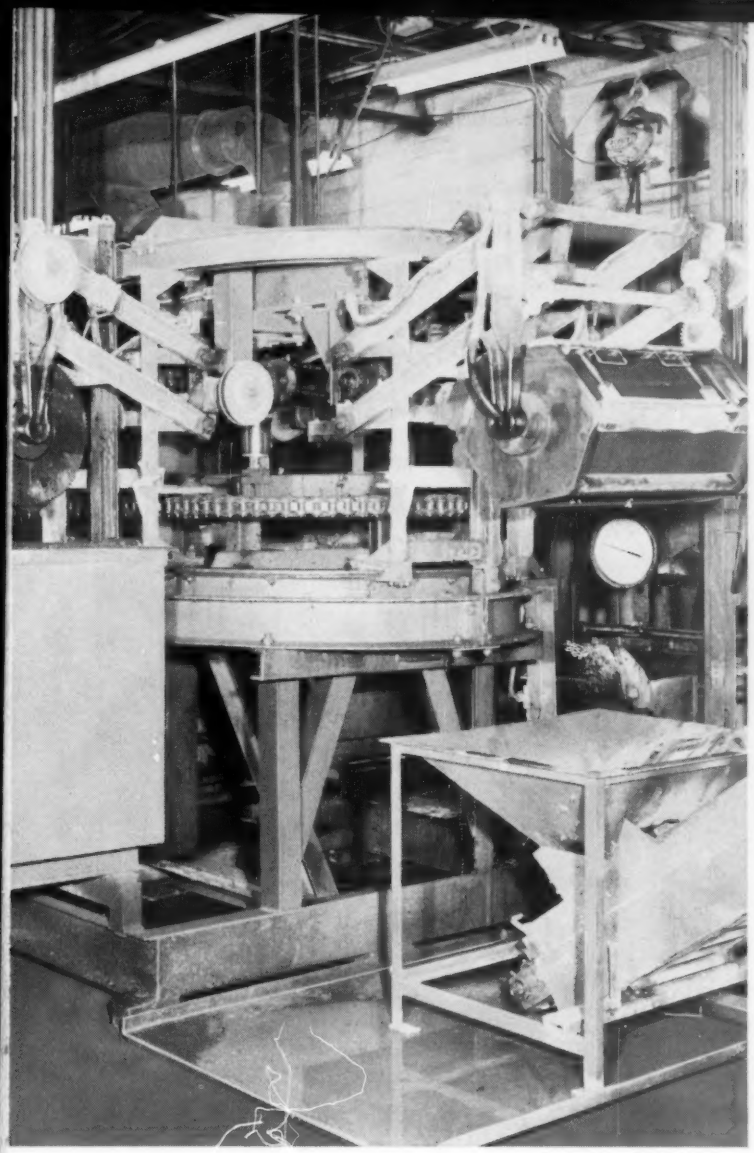
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Udylite tempron plating cylinders take 200-pound loads, 10 times a day . . . year after year.





"Udylite Tempron Plating Cylinders give us more for our money: economical performance, low maintenance and extra long service life," says Al Betteley of the Bellevue Plating Co.

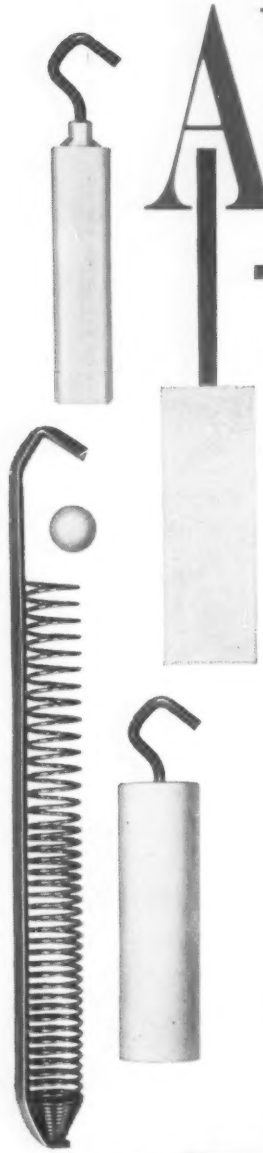
Al Betteley, Vice President and General Manager of Bellevue Plating, Detroit, Michigan, is more than satisfied with the performance and economy records set by Udylite Tempron Cylinders on his high-volume zinc plating operation. ■ "Rugged construction, maximum resistance to heat and abrasion, plus a design that practically eliminates maintenance problems, have made these Tempron Cylinders real cost-cutters in our plant," states Mr. Betteley. ■ Specializing in nut, fastener and automotive component plating, Bellevue Plating now has Tempron Cylinders in operation on two automatic barrel machine lines. Up to 200 pounds of parts per cylinder are processed at temperatures to 212° F.—then, they are immediately placed in a cold rinse. Lack of warping or softening at this great temperature variance makes Tempron Cylinders ideal for the plating job. ■ Look into the long range advantages of Udylite Tempron Cylinders on your plating and processing operations. You'll discover, just as Bellevue Plating has, that they'll give you more for your money year after year. Call your Udylite Representative today. Or, write direct for complete information:

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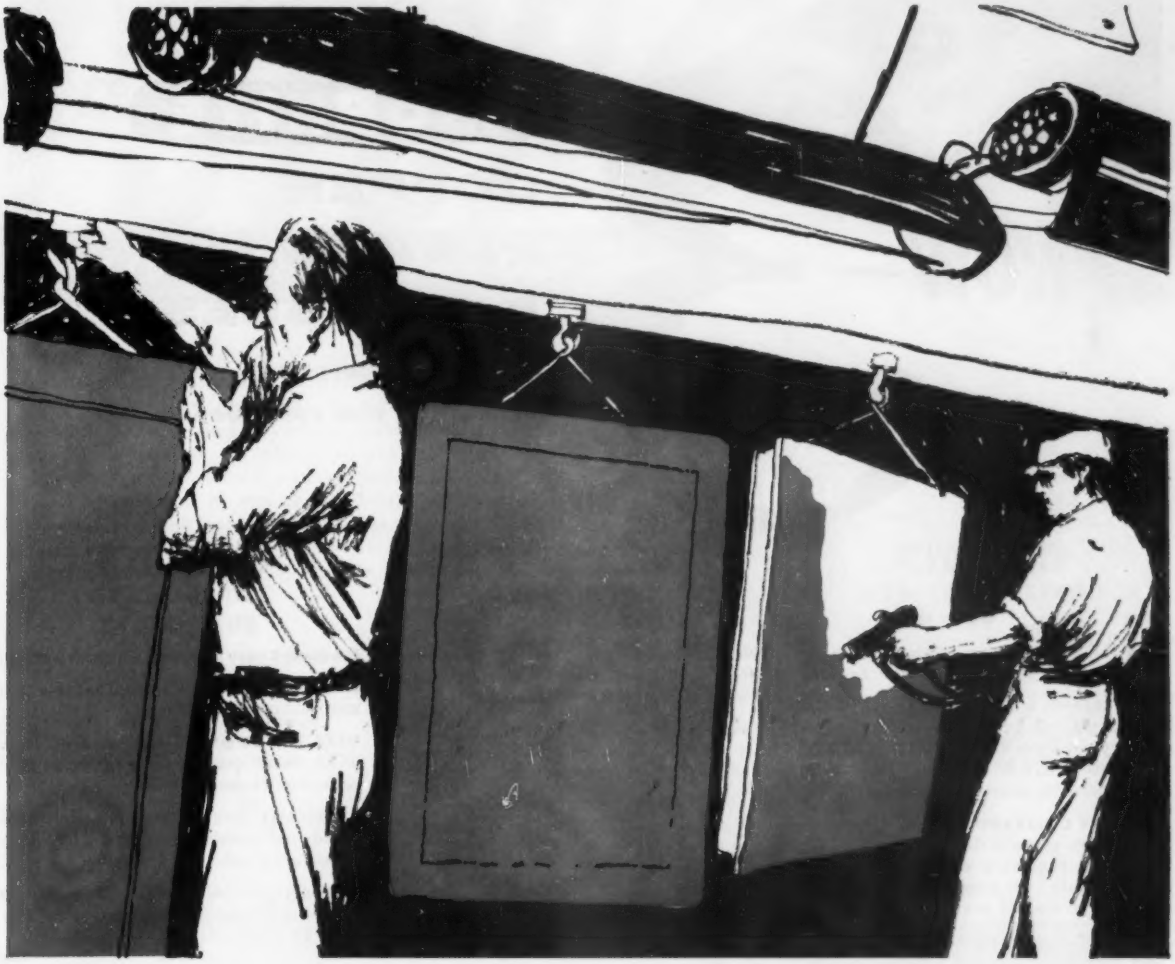
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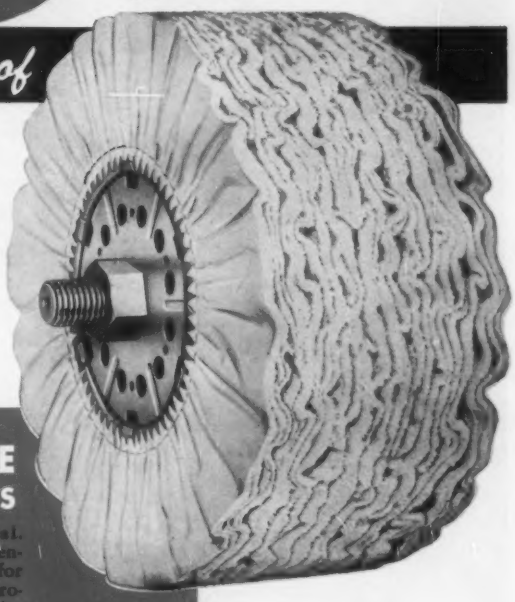
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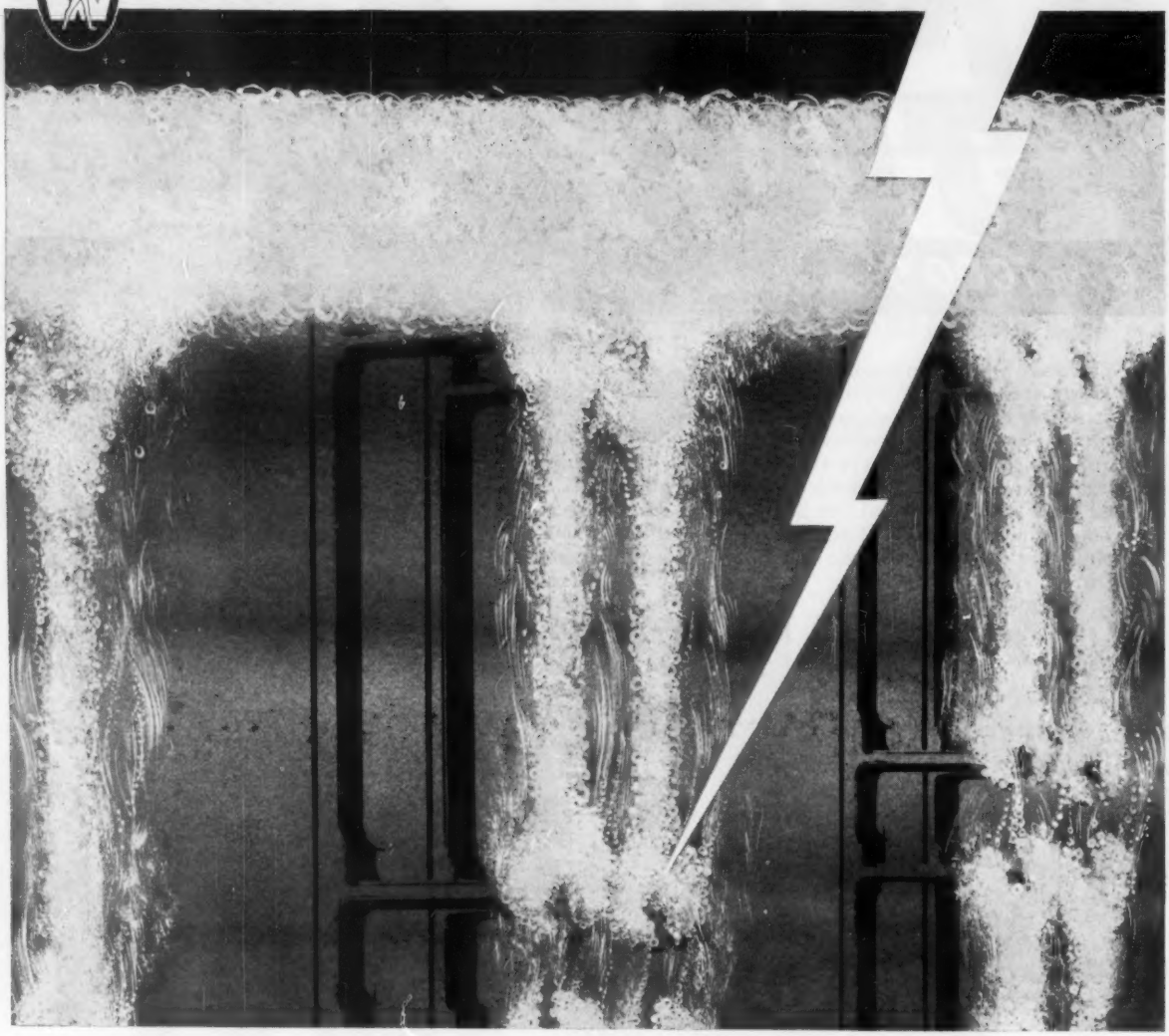
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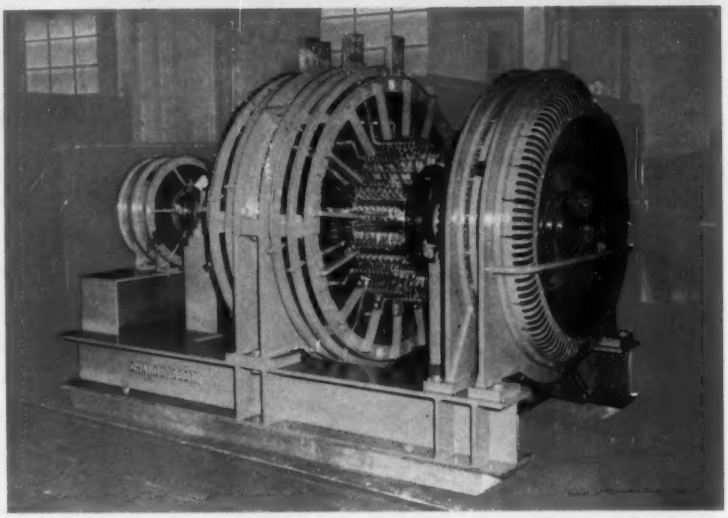
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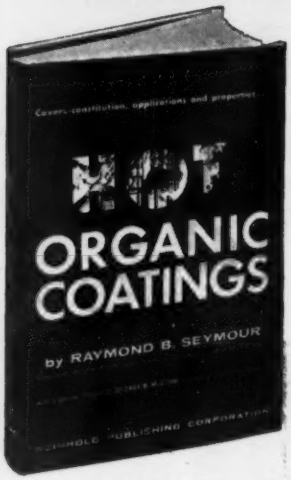
Covers constitution, applications and properties.

HOT ORGANIC COATINGS

by RAYMOND B. SEYMOUR
President, Alcylite Plastic and Chemical Corporation
With a special chapter by GEORGE B. McCOMB
Consultant to Suppliers of Pipe Line Coatings

1959, 244 pages, $7.50

The constitution, applications and properties of hot organic protective coatings are concisely presented here. The book contains chapters on widely used hot organic materials such as asphalt, coal-tar pitch, petroleum waxes and cellulose derivatives. Specific information on formulations of proprietary products is included. Additional chapters deal with hot melt applications without solvent such as peel coatings, protective linings, flame spraying and the fluidized bed process. One chapter on hot applied coal tar pitch base coatings is supplied by George B. McComb, consultant to the leading suppliers of pipe line coatings. Hot spray techniques and the many advantages of this application are also covered. This book will be helpful to everyone using these coatings in any form.



CONTENTS:

Coating Fundamentals
General Discussion of Hot Coatings
Asphalt and Related Products
Coal Tar Pitch
Petroleum Waxes
Synthetic Hydrocarbon Resins
Cellulose Derivatives
Animal, Vegetable & Insect Waxes
Miscellaneous Products
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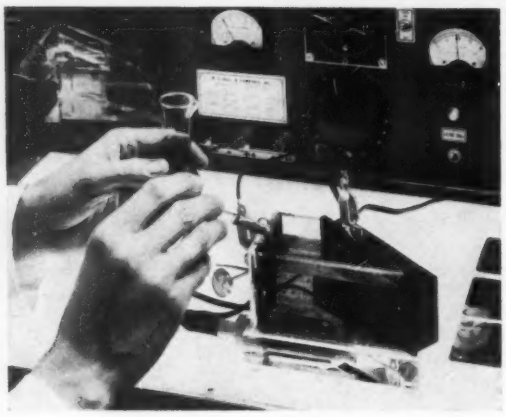
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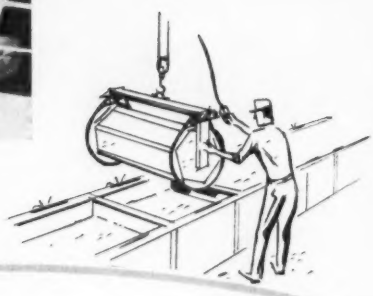
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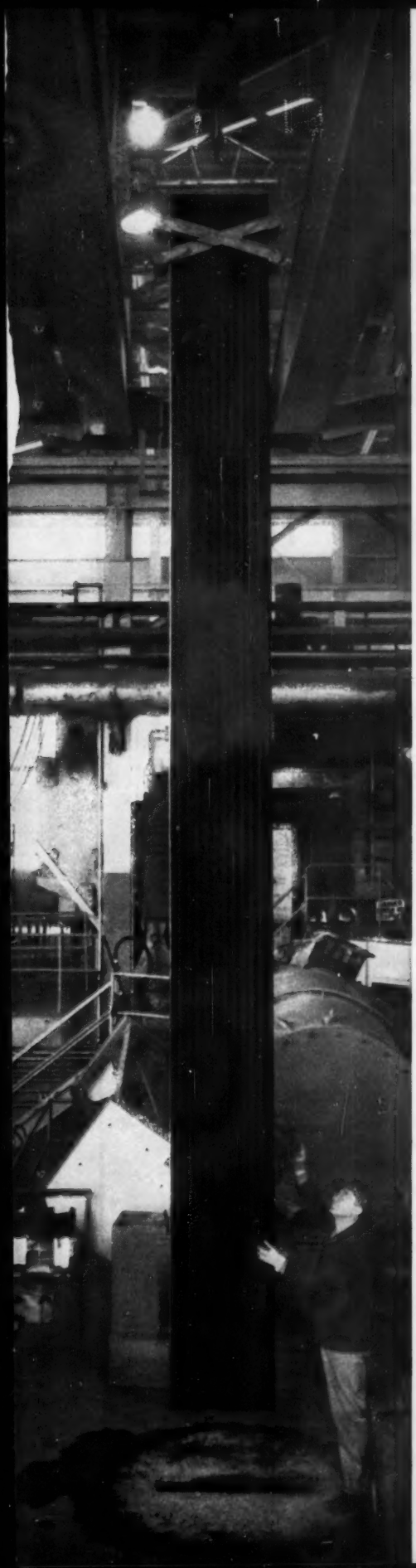
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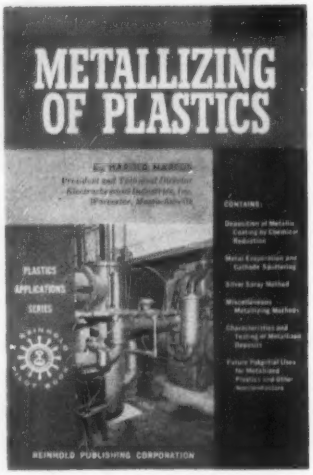
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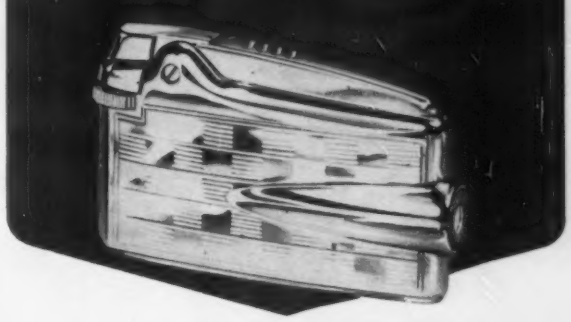
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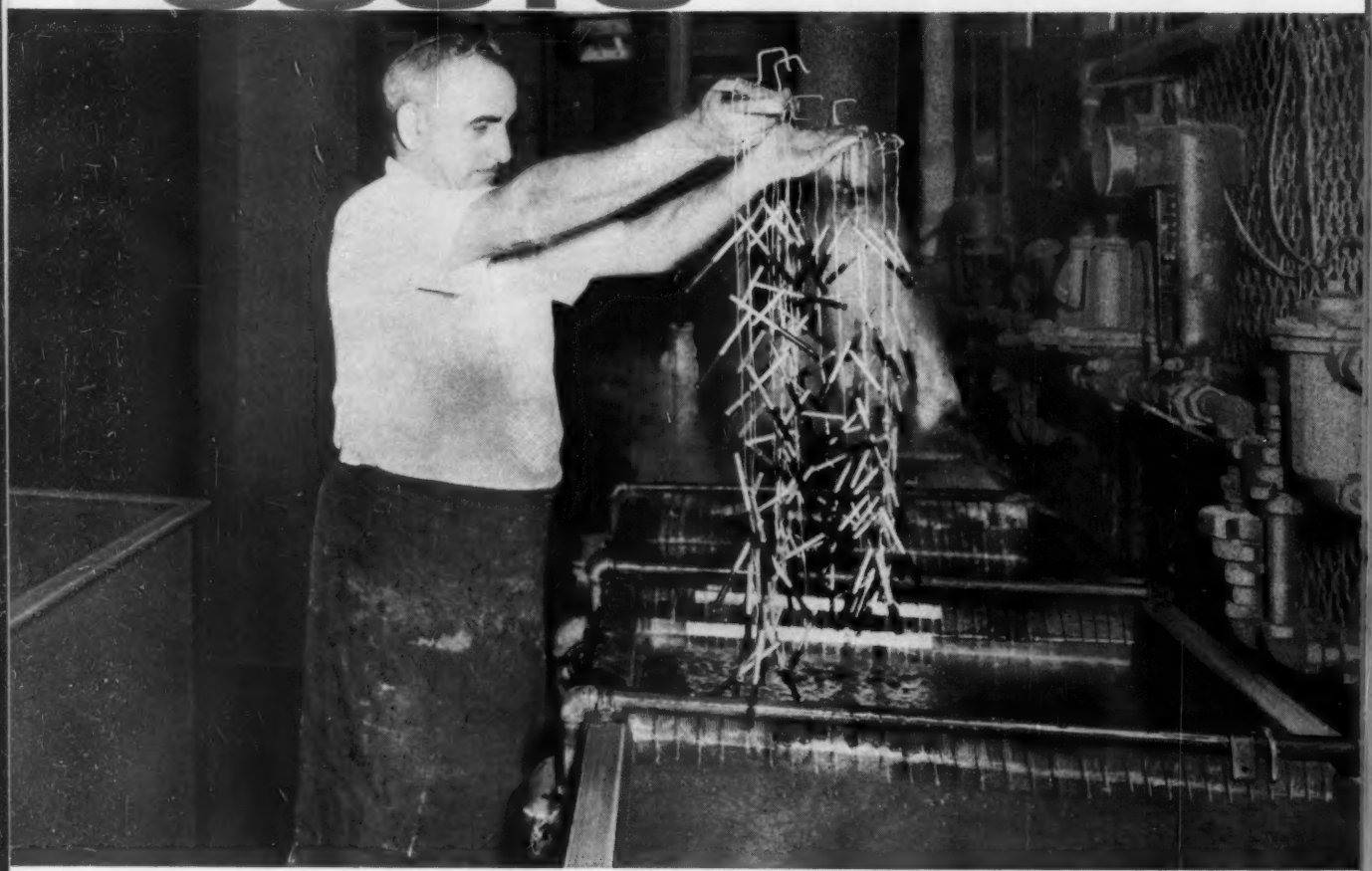
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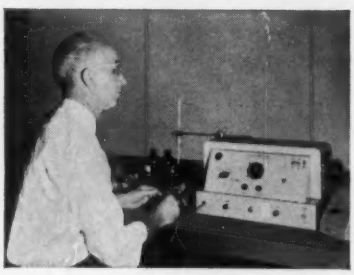
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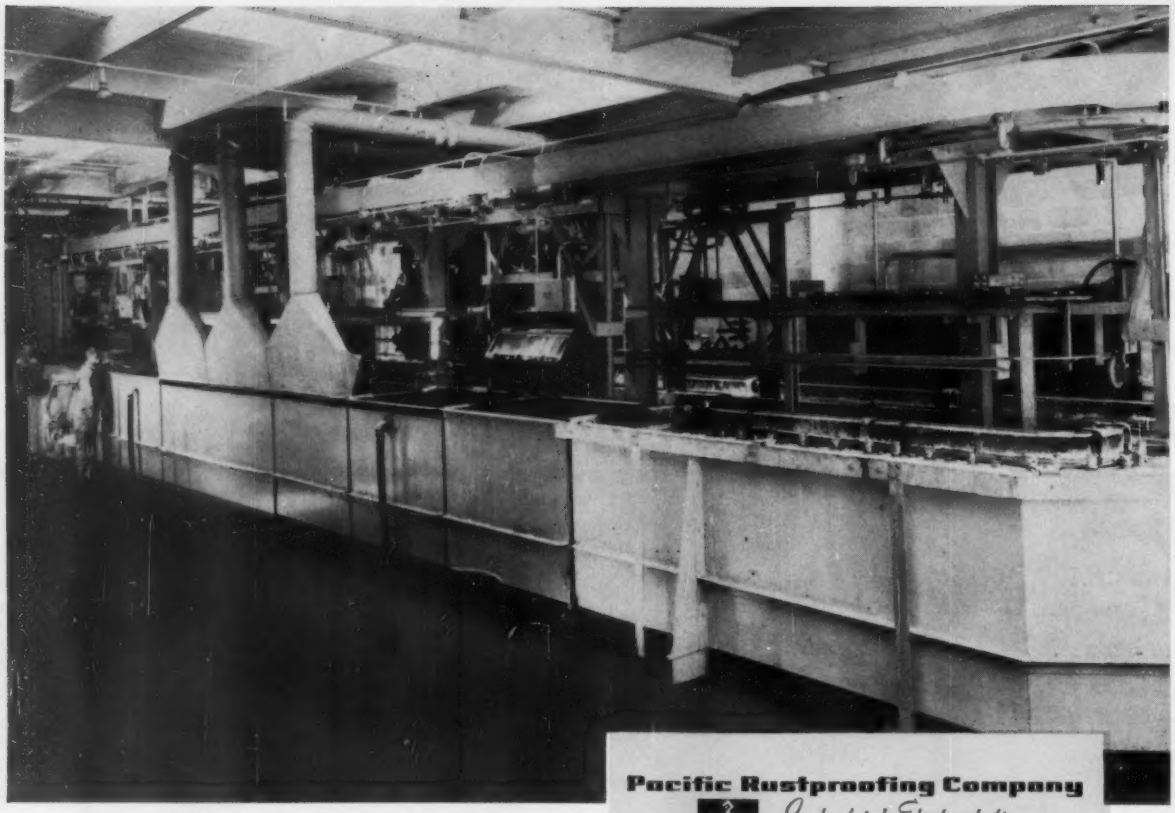
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NOVEMBER, 1961 Volume 59 No. 11

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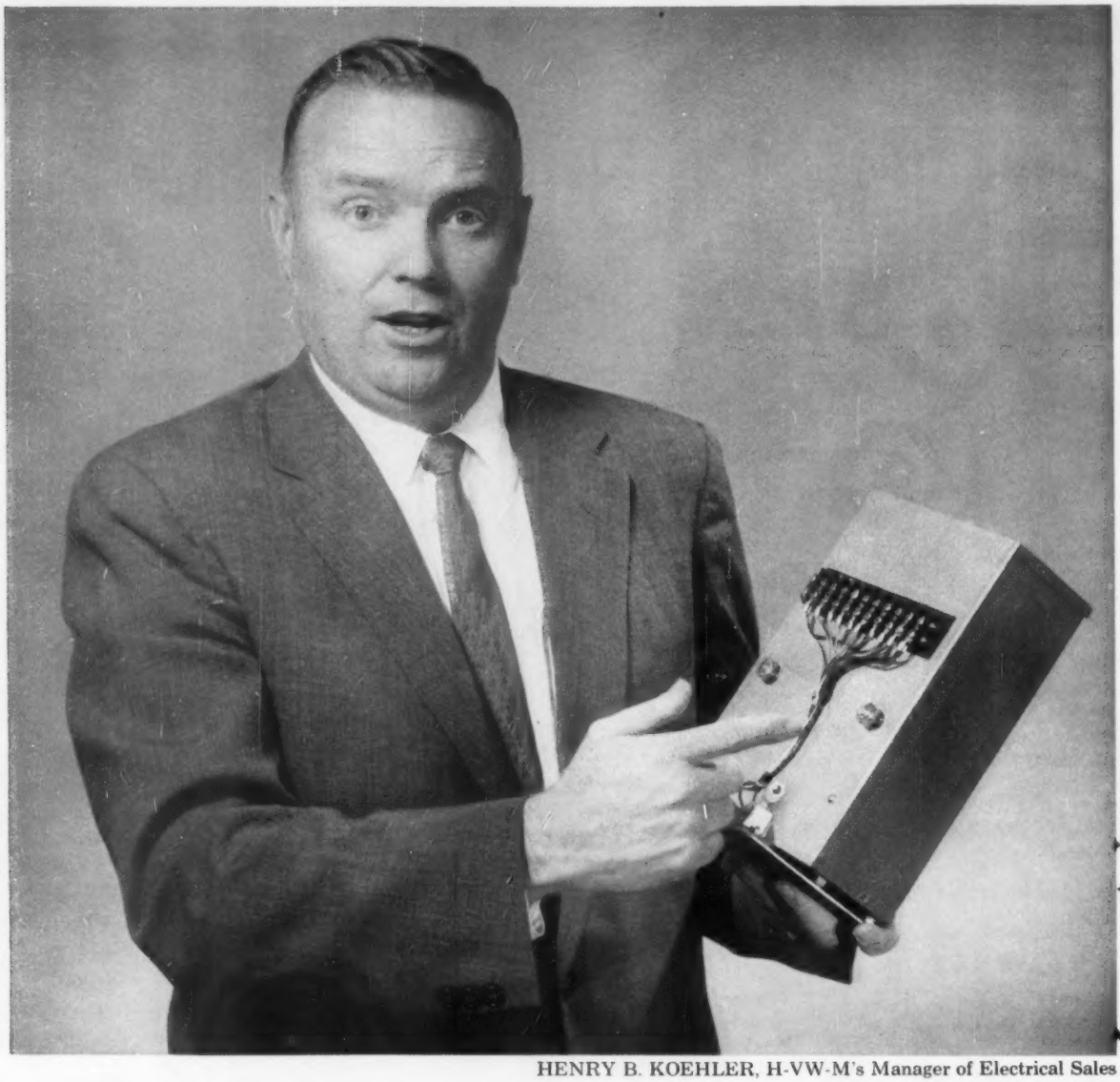
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PUBLISHER'S ANNOUNCEMENT

Although our feature pages regularly carry technical articles authored by eminent foreign scientists, many of our readers are probably unaware that *Metal Finishing* is, in fact, an international publication. For over fifty years it has been reaching forty-five other countries! Recently, a number of other American journals in the metal working and other fields have announced plans for international editions, and have embarked on extensive, ambitious plans to sell advertising to European and other firms. Since we are the international means of communication for the specialized finishing industry, an arrangement has now been worked out to insert an *Export Advertising Section,* beginning with this issue. Our American readers will not find it in their copies; however, we will be only too happy to send reprints to those who request them.

We take this opportunity to call the attention of our many friends and loyal readers in countries throughout the world to this new section. Now in our fifty-ninth year of publication, our service is broadened to help a manufacturer of, say, finishing equipment in England make a sale in Sweden, presenting his message in English or bilingually. The new service will enable the owners of a proprietary process in the U. S., for example, to establish a sales outlet in Japan through a special announcement in the export section and, thus, make immediate contact with prospects in this rapidly expanding area.

While the new section will contain advertising primarily, there will be translations of Nathaniel Hall's editorial page into German, French, and Spanish as well as certain news items. The editorial standards governing what appears will be the same as have applied to *Metal Finishing* over our 59 years of service to the finishing industries; that is, the interests of the reader will be our first consideration.

A passenger on a jet plane is quickly made aware of how the world has shrunk in size, and how, in the future, all industries in all countries will be brought in much closer. Our readers will benefit from our expanded activity since, by this means, we will learn of processes and methods which we will then be able to report in our pages. It will enable us to work even more closely and effectively with educational societies being formed in the finishing field in Europe, Asia, and South America. Previously, only our own country and Britain had organizations devoted to finishing, but this situation has now changed. Industrialization is taking root wherever man is seeking to better his lot in life, and that is why, with this issue, we are making this announcement.

Palmer H. Langdon

Publisher

Finishing to Government Specifications

By Boris B. Joffe, *President, Twin City Testing Corp., Tonawanda, N. Y.*

Chemical Films for Aluminum and Aluminum Alloys

Military Specification MIL-C-5541, dated Jan. 9, 1950 and amended March 28, 1950

I. REQUIREMENTS

All materials used for the production of the chemical films covered by this specification shall be suitable for the purpose intended, and the processes, themselves, shall be controlled and operated as to give a uniform product.

The film shall be continuous, free from breaks, scratches, and other damage.

The parts to be coated shall be thoroughly cleaned before processing, the casting skin removed where required; the cleaned surface shall be kept free from contamination.

Unpainted parts shall withstand a salt spray exposure or 168 hours, painted parts, 500 hours.

II. SAMPLING AND TESTING

Inspection tests shall be made by the contractor or by a commercial testing laboratory.

For inspection purposes, random samples, as described in this specification, shall be selected, once every three months, and submitted to inspection tests.

Unpainted panels shall be submitted to a salt spray exposure of 168 hours; if they show any evidence of corrosive attack, physical property tests shall be used for referee tests. Painted panels shall be tested for salt spray resistance, for adhesion, and for elongation, as outlined in this specification.

III. NOTES

Chemical films covered by this specification are intended for use as a paint base and as a corrosion preventive film; they may be used in lieu of anodic films, when so authorized by the Procuring Agency.

IV. HISTORY

This specification supercedes the Army-Navy Specification AN-C-170, dated March 5, 1948.

Black Oxide Coatings for Ferrous Metals

Military Specification MIL-C-13924A, dated December 26, 1956

I. SCOPE

This specification covers black oxide coatings applied to ferrous metals. Black sulfide coatings are not included in this specification.

II. CLASSIFICATION

Class 1: Alkaline oxidizing process for wrought iron, plain carbon, and low alloy steels.

Class 2: Alkaline-chromate oxidizing process for corrosion resistant steels.

Class 3: Fused salt oxidizing process for all grades corrosion resistant alloy and carbon steels having draw temperature above 900°F.

III. REQUIREMENTS

The contractor may select the materials for the black oxide processing.

Materials for supplementary preservative treatments and methods of application shall be in accordance with the paint or preservation specifications applicable to the end item.

Prior to processing, the basis metal shall be thoroughly cleaned, and the cleaned surfaces shall be free of rust, scale, grease, oil, paint, or other foreign matter.

The coating shall cover the basis metal completely, and its color shall be uniform black; there shall be no indication of any reddish-brown or green smut.

Class 1 and 2 black oxide coated parts shall be first rinsed in cold water, then in hot water at a temperature of 190°F., and then dipped for at least 30 seconds in a chromic acid solution maintained at a temperature of 150-190°F. and a pH of 2 to 3. After the dip, parts shall be dryed by warm dry air.

Class 3 coated parts shall be processed in a molten salt bath having a temperature of 900°F. or less. After processing, the parts shall be subjected to a cooling and draining period of 8 to 10 minutes, rinsed in boiling water, and dryed by warm, dry air.

Unless otherwise specified, the supplementary

preservation treatment shall be applied to the clean parts immediately after drying.

The black oxide coating shall be uniform and clean; smut, spottiness, or other discoloration shall be cause for rejection.

IV. Sampling and Testing:

For inspection purposes, the sampling shall be made in accordance with the quality assurance provisions applicable to the end item.

Each sample article shall be wiped with a white cloth for indication of smut.

The acceptance test for the coating shall be the oxalic spot test described in this specification.

V. Notes

Black oxide coatings give only a very limited corrosion protection.

The coating produces no material dimensional change of the treated part.

Black oxide coatings should normally be given a supplementary treatment.

VI. History

This specification supercedes the Specification MIL-F-13924 (ORD) of Dec. 23, 1954.

Porous Chromium Plating (Electrodeposited)

Military Specification MIL-C-20218C, dated Dec. 29, 1959

I. Classification

This specification covers porous chromium plating applied to cylinder bores of internal combustion engines.

This plating shall be one or more of the following types:

Type I: Channel.
Type II: Pin-point.
Type III: Intermediate.
Type IV: Grit blast.

II. Requirements

The plating furnished under this specification requires qualification prior to bids and has to be approved for inclusion into the Qualified Products List QPL-20218.

The deposition shall be made in a chromic acid bath, with the same process that was used for qualification purposes.

The minimum coating thickness of the porous chromium plate shall be 0.005 inch after final honing.

If approved by the procuring agency, an electrodeposited alloy undercoating will be acceptable, provided its thickness does not exceed 0.26 inch.

Unless otherwise specified, the finished chrome plated surface shall have 20-40% porosity over the area swept by the piston rings; deviations in porosity are permissable if held within the range outlined in this specification.

Twenty-four photomicrographs are part of this specification and the different types of porous chromium plating shall conform to the surface porosity shown by these pictures.

For Type I plating, a certain plateau size has to be met.

Furthermore, this specification limits the size, number and position of allowable pits and prescribes the radiing of port edges.

The chromium plating, after finishing, shall be free of all loose material, such as finely divided chromium or honing stone material, from the finishing operation.

Any cylinder rejected because of defective plating may be replated, provided the chrome is completely stripped prior to replating.

III. Quality Assurance Provisions

Unless otherwise specified, the supplier is responsible for the performance of all inspection requirements prior to Government inspection and acceptance.

A sample lot of 6 GM model 71 cylinders shall be submitted for qualification tests; these tests shall be conducted at a Government Laboratory, designated by the Bureau of Ships.

Coating thickness measurements shall be made, after finish honing, by means of a magnetic or electromagnetic gage; bore dimensions shall be measured with a micrometer.

Porosity shall be determined, at a 50 diameter magnification, by photomicrography.

Accelerated and engine wear tests shall be performed as outlined in this specification.

Tests for surface cleanliness shall be made by means of adhesive tape, first applied and then removed from the test area.

This specification also gives a classification of defects in accordance with Standard MIL-STD-105.

The preservation and packaging of plated cylinders is of importance and completely defined in this specification.

IV. History

This specification supercedes the Military Specification MIL-P-0020218B (SHIPS), dated October 31, 1957 and the Military Specification MIL-P-20218, dated Oct. 29, 1951.

Requirements for Electroless Nickel-Phosphorus Coatings

Military Specification MIL-C-26074A, dated Apr. 27, 1959

I. Classification

The electroless nickel-phosphorus coating shall be of the following classes, as specified:

Class 1: As coated condition.
Class 2: Conditioned for improved hardness.

II. Requirements

The electroless nickel-phosphorus coating shall be produced in a bath containing salts of nickel and sodium hypophosphites; its deposition shall depend upon the reducing action of the hypophosphite.

The basis metal shall be free from defects detrimental to the appearance or performance of the coating.

The coating shall be free from defects and of good appearance. Slight discoloration resulting from heat

treatment or baking after plating shall not be cause for rejection.

The equipment and processes employed in the production of the coating shall be subject to the approval of the procuring activity.

Unless otherwise specified, the coating shall be applied after all basis metal heat treatments and mechanical operations on the part to be coated have been completed.

All steel parts, having a hardness greater than Rockwell C 40, shall be stress relieved prior to coating if they contain objectionable residual stresses; this treatment shall not diminish the initial hardness.

Unless otherwise specified, the coating shall be used only on iron, copper, aluminum, nickel, and cobalt alloys.

After coating, all Class 2 coated parts shall be heat treated so that the coating has a hardness of 700 Vickers minimum.

Steel parts designed for unlimited life under dynamic loads shall be shot peened before coating.

All steel parts, having a hardness of Rockwell C 40 or above, shall be baked at 375° ± 25°F. for three hours after coating. The heat treatment time used for Class 2 coatings may be considered in computing the baking time required above.

All steel parts, having an ultimate tensile strength of 220,000 psi, or above, shall not be coated without specific approval of the procuring activity.

After coating, all aluminum parts shall be baked at 300° ± 5°F. for 1 hour.

Unless otherwise specified, the minimum thickness of the nickel coating shall be 0.001 inch for iron and aluminum alloys, and 0.0005 inch for copper, nickel and cobalt alloys.

III. Sampling and Testing

For inspection purposes, the sampling procedure outlined in this specification shall be used.

Unless otherwise specified, the supplier shall be responsible for the performance of all inspection requirements prior to submission for Government acceptance.

Adhesion shall be tested either by the bend test or by scraping the coating off the basis metal.

Hardness tests shall be made on steel specimens, having a coating thickness of 0.003 inch minimum, with a Vickers machine employing a 1 kg. load; other methods may be used for hardness measurements of thinner coatings.

Separate specimens shall not be used for thickness measurements unless the necessity for their use has been demonstrated.

Thickness measurements shall be made on the coated article where the coating would be expected to be the thinnest.

Thickness measurements may be made either with instruments or the metallurgical microscope, but whatever method is used, the readings obtained shall be within plus or minus 10% of the true coating thickness.

IV. Notes

Class 1 coating is intended for decorative coating and corrosion prevention.

Class 2 coating is intended for wear, abrasion, and corrosion resistance.

Lead, cadmium, tin, bismuth, zinc, and antimony cannot be coated, and usually prevent coating or cause poor coating on the part with which they are associated.

Aluminum alloys are heated after coating to improve the bond between the coating and the basis metal.

The temperature and time required for obtaining the desired hardness in electroless nickel coating varies with their chemical composition. Heat treatment at approximately 500°F. for 1 hour should result in an electroless nickel coating having a minimum hardness of 700 Vickers.

V. History

This specification supercedes the Military Specification MIL-N-26074 (USAF) dated Nov. 27, 1956.

Chemical Black Finish for Copper Alloys

Military Specification MIL-F-495A, dated August 25, 1953

I. Scope

This specification covers a black chemical finish to be used for decorative or corrosion retardment purposes on cupreous alloys.

II. Requirements

Any raw material may be used as long as the finish obtained meets the requirements of this specification.

The black chemical finish shall be produced by chemical or electrochemical treatment of the copper-alloy surface. The processed parts shall be thoroughly cleaned before, and thoroughly rinsed after, processing.

Where the finish is to be used as a base for an organic coating, the rinsing shall be followed by a thirty second dip in a weak chromic acid solution (0.5 oz./gal.).

The finish shall be black and completely cover the color of the underlying metal. Gloss shall be 25 maximum, when measured per Specification TT-P-141. The gloss requirement is waived when the finished part is to be coated by an organic substance.

The finish shall be submitted to the hot soap solution test as well as to the accelerated weathering test, described in this specification.

The finish shall be uniform, of good adhesion, and free of any defects which are detrimental to its use.

III. Sampling and Testing

For inspection purposes, the sampling and inspection procedures of the specification for the end item shall be used.

IV. History

This specification supercedes the specification JAN-F-495, dated Sept. 25, 1947.

Lead Plating (Electrodeposited)

Military Specification MIL-L-13808 (ORD), dated Nov. 29, 1954

I. Classification

Lead plating shall be of the following types:

Type I: without preliminary copper coating.
Type II: with a preliminary copper coating, being at least 0.000015 inch thick.

and of the following classes:

Class 1: 0.001 inch thick.
Class 2: 0.0005 inch thick.
Class 3: 0.00025 inch thick.

II. Requirements

The basis metal shall be free from defects detrimental to the appearance or the protective value of the plating.

The plating shall be free from defects and of good appearance.

Unless otherwise specified, the plating shall be applied after all basis metal heat treatments and mechanical operations on the part to be plated have been completed.

All parts, having a hardness greater than Rockwell C 40 and *not* subject to flexure or repeated impact, shall be stress relieved prior to plating if they contain objectionable residual stresses.

Springs or other parts, which are subject to flexure or repeated impact in their normal functions, shall be baked at 375° ± 25°F. for three hours after plating. Hardened parts, which have been heat treated previously at a temperature below 375°F., including carburized parts, shall not be heated as above.

The minimum thickness of the coating at any point on the surface of the plated item shall not be less than 70 per cent of the minimum average thickness stipulated for the specified class of plating; the latter thickness is required on all surfaces which can be touched by a sphere 0.75 inch in diameter.

Type I and Type II coatings shall be able to withstand salt spray exposure as outlined in the following table:

Class	*Salt spray exposure time in hours*
1	96
2	48
3	24

III. Sampling and Testing

For inspection purposes, the sampling procedure outlined in this specification shall be used.

Adhesion shall be tested either by the bend test or by scraping the coating off the basis metal.

Separate specimens shall not be used for thickness measurements unless the necessity for their use has been demonstrated.

Thickness measurements may be made by drop test, by approved instruments, or by means of the metallurgical microscope; the latter method shall be used as referee test.

Measurements on threaded articles shall be made on the shank or other smooth surfaces as close to the threads as possible.

IV. Notes

Plating of lead coatings on ferrous alloys is done to prevent corrosion; on cupreous alloys, to prevent corrosion and/or facilitate soldering.

Type II coatings shall be used for all applications except when the copper undercoating is detrimental to the use; this undercoat does not only increase the salt spray resistance of the lead coating by as much as a factor of two, but also improves the adhesion of the coating to the steel.

V. History

This specification supercedes, in part, the Army Specification 57-O-2C, dated Dec. 11, 1943.

Heavy, Manganese or Zinc Phosphate Coatings (For Ferrous Metals)

Military Specification MIL-P-16232B, dated July 9, 1958

I. Scope

This specification covers heavy phosphate coatings for ferrous metals; light phosphate coatings, for use as a paint base, are not included.

II. Classification

The coatings shall be of the following types and classes:

Type M — Manganese phosphate base:
Class 1: Supplementary treatment as specified.
Class 2: Treated with lubricating oil.
Class 3: No supplementary treatment.

Type Z — Zinc phosphate base:
Class 1: Supplementary treatment, as specified.
Class 2: Treated with drying-type preservative.
Class 3: No supplementary treatment.
Class 4: Sealed with inorganic salt.

III. Requirements

Unless otherwise specified, preproduction approval is required, as outlined in this specification.

Unless otherwise specified, the phosphate coatings shall be applied after all basis metal heat treatments and mechanical operations on the part to be coated have been completed.

Unless otherwise specified, parts having a hardness greater than Rockwell C 40, including carburized parts, shall be stress relieved prior to coating. In addition, they shall be hydrogen embrittlement relieved after the coating in conformance with table I.

TABLE I

Type of Coating	*Temperature*	*Time at Temperature*
M	210-225°F.	1 hour
Z	200-210°F.	15 minutes

The phosphate coatings shall be uniformly crystalline, grey to black, and shall not have a mottled appearance. They shall be free of white stains, rust, and fingerprints. Brown or orange stains caused by a chromic acid rinse, and nonuniformity of color, due to heat treatment, degree of cold work, or composition of the basis metal, shall not be cause for rejection.

Phosphate coatings, prior to the application of any supplementary treatment, shall have the following minimum weights:

Type M coatings: 1500 mg. per sq.ft.
Type Z coatings: 1000 mg. per sq.ft.

a.) *Type M Coatings*:

These coatings are more resistant than Type Z coatings to alkaline environments, and should not be exposed to temperatures in excess of 250°F.

1.) *Class 1*: The supplementary preservative and its weight per unit area are to be as specified.

2.) *Class 2*: Unless otherwise specified, the weight per unit area of oil shall be such that items show no signs of corrosion upon subjection to a salt spray test for 24 hours.

3.) *Class 3*: The phosphate coated items shall show no sign of corrosion when submitted to a salt spray exposure of 1½ hours. If authorized by the procuring agency, the Springfield immersion test can be used in lieu of the salt spray test.

b.) *Type Z Coatings*:

These coatings should not be used if contact with alkaline materials, or exposure to temperatures over 200°F., is expected. Type Z coatings may be used to prevent galling in cold-extrusion and deep drawing applications.

1.) *Class 1*: The supplementary preservative and its weight per unit area shall be as specified.

2.) *Class 2*: Unless otherwise specified, the weight per unit area of oil shall be such that items show no signs of corrosion upon subjection to a salt spray test for 48 hours.

3.) *Class 3*: The phosphate coated items shall show no sign of corrosion when submitted to a salt spray exposure of 2 hours. If authorized by the procuring agency, the Springfield immersion test can be used in lieu of the salt spray test.

4.) Inorganic salt-sealed coatings are suitable for application to fire-control instruments and personal hardware, and for uses where a petroleum-base supplementary treatment cannot be used. The coating can be dyed to various shades and colors, such as black or olive-drab. The coated items of this class shall show no signs of corrosion upon subjection to a salt spray test for 24 hours.

IV. Sampling and Testing

For inspection purposes, the sampling procedure outlined in this specification shall be used.

If the processed item cannot be submitted to the tests outlined in this specification, test specimens having an external surface of not less than 4 sq.in., and no more than 50 sq.in., may be used instead. Test specimens shall be used only once and, then, discarded.

This specification describes the methods by which the weights of the coatings and of the supplementary preservatives are to be determined, as well as the salt spray and Springfield immersion test.

V. Notes

Type M coatings have an expected thickness of 0.0002″-0.0004″; type Z coatings of 0.0002″-0.0006″.

Items should not be stressed until relieved of hydrogen embrittlement. This relief may be accomplished by aging at room temperature for at least 64 hours, or by baking as described above.

This specification also gives a general outline for a five stage phosphating line.

Although this specification supercedes the Military Specifications MIL-C-16232A (N Ord) of Feb. 1, 1955, and MIL-C-12968 (ORD) of Aug. 11, 1953, the table below will give the comparison between the former and new classifications.

Classification comparison

This Specification	*MIL-C-16232A*	*MIL-C-12968*
Type M, Class 1	.....	Type A
Type M, Class 2	Type I	.....
Type Z, Class 1	.....	Type B, Class 1
Type Z, Class 2	Type II	.....
Type Z, Class 4	.....	Type B, Class 2

Black Nickel Plating (Electrodeposited) On Brass, Bronze, or Steel

Military Specification MIL-P-18317 (ORD), dated Dec. 22, 1954

I. Scope

This specification covers one grade of black nickel plating, applicable where a minimum distraction of the operators vision is desired, as in the interior of optical instruments.

II. Requirements

The basis metal shall be free from visible defects detrimental to the appearance or performance of the black nickel coating.

Unless otherwise specified, the plating shall be applied after all mechanical operations on the part to be plated have been completed.

Unless otherwise specified, the plating shall be applied to the basis metal without intermediate coating.

The deposit shall be of a uniform black color and completely cover all surfaces so indicated on the applicable drawing.

III. Sampling and Testing

For inspection purposes, the sampling procedure outlined in this specification shall be used.

Adhesion shall be tested by scraping the coating off the basis metal.

The color of the coating shall be tested by comparing with the color of the standard samples prepared prior to production.

IV. Notes

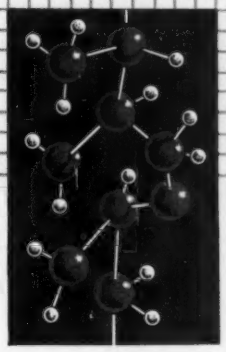
Black nickel plating is applied for the purpose of producing black, nonreflective surfaces.

A typical black nickel solution is given:

Nickel ammonium sulfate	8 oz./gal.
Zinc sulfate ($7H_2O$)	1 "
Sodium thiocyanate	2 "
Temperature	75-95°F.
pH	5.8-6.1 (electrometric)
Cathode current density	0.5-1.5 amp./ft.^{2}
Plating time	20 to 40 minutes

V. History

This specification supercedes Type A of the Navy-Ordnance Specification NAVORD OS 1671.



SYNTHETIC RESINS

The Backbone of Modern Finishes

A SURVEY OF THE LATEST DEVELOPMENTS IN SYNTHETIC RESINS USED IN COATINGS

Part XI - Alkyds (Section B)

By Harold P. Preuss

IN the previous article in this series we described in a general way the basic chemistry of alkyd resins and told something of their uses. In this article we will describe some additional characteristics of these resins.

Classification

One common way of classifying alkyds is to divide them into baking, air drying, or non-drying types. These may be described as follows:

Baking Type Alkyds

These are usually high in phthalic anhydride content. They are favored over oleoresinous vehicles because of their superiority in color and retention of color. They are frequently distinguished by outstanding adhesion, toughness, fullness, gloss, pale color, and durability. The choice of the particular grade of alkyd is determined by such factors as the baking conditions of time and temperature, and by requirements of color, surface hardness, durability and economy. This class finds its greatest utility in baking primers and enamels for refrigerators and stoves, vehicles for metal decorating, auto, truck and railway finishes. They are widely used in infrared baking systems because of their excellent baking characteristics.

Air-drying Alkyds

The special advantages of alkyds in air-drying finishes are pale color and retention of color and gloss over long periods of exposure. They are of particular importance, therefore, in finishing enamels, especially white enamels.

In the selection of alkyd resins for air-drying finishes and in the formulation of the finish, consideration must be given to such properties as drying characteristics, viscosity, vehicle solids, stability with pigments, brushing characteristics, and retention of color. An alkyd vehicle generally will not display the easy brushing qualities of long-oil varnishes and oils. The alkyd ratio and the viscosity of the resin are the most important determining factors, but correct formulation, including the proper balance of solvents, will go a long way toward minimizing the differences. In general, resins containing lower quantities of phthalic anhydride (24 to 32%) are most widely used for brushing enamels.

Non-drying Alkyds

This type usually functions as a plasticizer or toughener for a harder, more brittle material, such as nitrocellulose, melamine or urea resins. Or, depending upon the ratios involved and the point of view, one may say that a cellulose derivative or a urea or melamine formaldehyde resin is needed to "harden" this type.

Growth of Alkyds

The growth in the use of alkyd resins used in surface coatings has been phenomenal. The reasons for this growth are threefold:

Versatility. Alkyds are adaptable to a wide variety of finishes for wood, metal, plaster, paper and plastics. In addition they may be used as plasticizers for cellulose nitrate.

Uniformity. The production of alkyd resins requires the use of strict chemical controls. Thus the individual judgment of the varnish maker has been replaced by

PROPERTIES OF ALKYD RESINS
(FOR USE ON METAL SURFACES)

MANUFACTURER	RESIN	% SOLIDS	SOLVENT	COLOR GARDNER 1933	ACID NO.	VISCOSITY GARDNER-HOLDT	POUNDS PER GALLON	% PHTHALIC ANHYDRIDE	% OIL	TYPE OF OIL	PROPERTIES	APPLICATIONS
FRANCE CAMPBELL AND DARLING	FCD 514	70	MIN. SPIRITS	5-8	6-10	Z_2-Z_4	8.0	23	65	SOYA	OUTSTANDING WEATHER RESISTANCE	MARINE FINISHES
	FCD 517	60	MIN. SPIRITS	5-8	5-10	Z-Z_2	7.9	30	50	SOYA	EXCELLENT WEATHER RESISTANCE	BAKING PRIMERS
	FCD 518	50	MIN. SPIRITS	5-8	6-10	V-Y	7.6	30	50	SOYA	EXCELLENT WEATHER RESISTANCE	METAL DECORATING ENAMELS
	FCD 521	50	MIN. SPIRITS	7-10	6-10	Z_2-Z_4	7.7	30	50	SOYA	GOOD FAT AND GASOLINE RESISTANCE	INDUSTRIAL AND FARM IMPLEMENT ENAMELS
	FCD 522	50	MIN. SPIRITS	7-10	6-10	T-W	7.6	30	50	SOYA	EXCELLENT WEATHER RESISTANCE; GOOD GASOLINE RESISTANCE	COLORED ENAMELS; STRUCTURAL STEEL FINISHES AND TRIM COLORS
	FCD 523	50	MIN. SPIRITS	6-9	5-10	Z_2-Z_5	7.7	30	50	SOYA	EXCELLENT WEATHER RESISTANCE	INDUSTRIAL BAKING PRIMERS; METAL AND WOOD CABINET FINISHES
	FCD 527	70	MIN. SPIRITS	9-11	6-10	Y-Z_2	8.0	23	65	LINSEED	OUTSTANDING WEATHER RESISTANCE	STRUCTURAL STEEL PRIMERS & TOP COATS
	FCD 528	70	MIN. SPIRITS	7-10	6-10	Y-Z_2	8.0	23	65	SOYA	OUTSTANDING WEATHER RESISTANCE	MARINE PAINTS; ALUMINUM PAINTS
	FCD 530	50	MIN. SPIRITS +15% XYLOL	6-8	5-10	W-Z	7.7	30	50	LINSEED	GOOD FAT AND GASOLINE RESISTANCE	AUTOMOTIVE PRIMERS AND ENAMELS
	FCD 535	50	MIN. SPIRITS	10-12	7-12	R-U	7.6	-	40	DEHYDRATED CASTOR	EXCELLENT FAT AND ALKALI RESISTANCE; ACID RESISTANCE GOOD	CHEMICAL RESISTANT INDUSTRIAL COATINGS
	FCD 544	50	XYLOL	5-7	5-10	Z_3-Z_5	8.1	40	38	SOYA	BAKED FILM RESISTANT TO ACID, ALKALI; FATS AND WEATHER	WHITE BAKING ENAMELS AND PRIMERS
	FCD 545	50	XYLOL	6-8	6-10	U-W	8.1	40	38	SOYA	BAKED FILM RESISTANT TO ACID, ALKALI, FATS, AND WEATHER	WHITE BAKING ENAMELS AND PRIMERS
	FCD 547	50	SOLVESSO #150 OR EQUAL	2-5	4-8	Z-Z_3	8.3	40	38	DEHYDRATED CASTOR	RETAINS FLEXIBILITY, RESISTS ALKALI, ACIDS, FATS, WEATHER	CAN COATINGS; VENETIAN BLINDS
	FCD 555	50	XYLOL	8-10	8-12	X-Z	8.3	36	30	DEHYDRATED CASTOR	GOOD WEATHER RESISTANCE	FAST AIR-DRY INDUSTRIAL FINISHES
	FCD 559	50	XYLOL + 5% BUTANOL	2-5	4-8	Z-Z_2	8.3	40	38	DEHYDRATED CASTOR	RETAINS GLOSS AND FLEXIBILITY ON LONG EXPOSURE	GENERAL PURPOSE BAKING ENAMELS
	FCD 565	60	XYLOL	2-5	4-8	Z_2-Z_4	8.5	40	38	NON-DRYING	PROPERTIES DETERMINED BY TYPE AND EXTENT OF MODIFICATION	HIGH BAKE WHITE ENAMELS; AUTOMOTIVE LACQUERS
	FCD 566	60	XYLOL	2-5	4-8	X-Z	8.5	38	40	NON-DRYING	PROPERTIES DETERMINED BY TYPE AND EXTENT OF MODIFICATION	PLASTICIZER FOR NITROCELLULOSE LACQUERS; ESPECIALLY HOT SPRAY WORK
	FCD 572	50	V.M.&P.	6-9	6-10	W-Z	7.7	25	30	SOYA	GOOD WATER AND WEATHER RESISTANCE	FAST AIR DRY AND BAKING FINISHES WITH GOOD COLOR RETENTION
	FCD 577	45	V.M.&P.	6-8	6-10	U-X	7.7	20	40	TALL OIL	FAIR ACID, ALKALI, FAT, RESISTANCE	INEXPENSIVE INDUSTRIAL BAKING FINISHES
	FCD 598	60	XYLOL	1-4	4-8	Z_2-Z_4	8.5	40	38	NON-DRYING	FILM PROPERTIES DETERMINED BY MODIFICATIONS	PLASTICIZER FOR NITROCELLULOSE LACQUERS
COOK	COROC N-25-A2	70	XYLOL	3-5	4-8	S-T	8.58	36	47	COCONUT	MINIMUM DISCOLORATION; HIGH ADHESION	APPLIANCE AND CABINET LACQUERS
	COROC C-2177-A2	61	XYLOL	3-5	2-7	Z-Z_1	8.60	38	43	CASTOR	EXCELLENT CHEMICAL STAIN, GREASE RESISTANCE	APPLIANCE WHITES
	COROC N-3341-A2	50	XYLOL	3-5	0-10	Z_1-Z_3	8.45	48	27	LAURIC	GOOD COLOR RETENTION; ALKALI AND SOAP RESISTANT	REFRIGERATOR; NON-CHALKING EXTERIOR ENAMELS
	COROC N-5785-M	50	X-B	4-6	10-14	T-U	8.40	48	27	NON-DRYING	LOW COST; HIGH SOLIDS ENAMELS	NON-CHALKING AUTOMOTIVE ENAMELS
	COROC N-6215-A2	60	XYLOL	1-2	9-10	W-X	8.53	-	-	(special)	SUPERIOR FLEXIBILITY, ADHESION	SPACE HEATERS; STOVE FINISHES
	COROC N-6248-M	50	X-B	1-4	4-8	T-U	8.48	49	27	NON-DRYING	HIGH SOLIDS ENAMELS; NON-YELLOWING	NON-CHALKING AUTOMOTIVE FINISHES
	COROC N-6828-A2	60	XYLOL	1-4	10-15	Z-Z_2	8.56	44	38	NON-DRYING	SIMILAR TO N-6248-M BUT ALLOWS GREATER SOLVENT SELECTION	NON-CHALKING EXTERIOR ENAMELS; LACQUER PLASTICIZER
	COROC L-26-H4	60	AROMATIC	7-9	5-8	W-Y	8.20	36	51	LINSEED	GOOD COMPATIBILITY; HIGH GLOSS	LOW TEMPERATURE BAKING ENAMEL

PROPERTIES OF ALKYD RESINS
(FOR USE ON METAL SURFACES)

MANUFACTURER	RESIN	% SOLIDS	SOLVENT	COLOR GARDNER 1933	ACID NO.	VISCOSITY GARDNER-HOLDT	POUNDS PER GALLON	% PHTHALIC ANHYDRIDE	% OIL	TYPE OF OIL	PROPERTIES	APPLICATIONS
COOK (continued)	COROC L-33-A2	59-61	XYLOL	6-8	10-14	V-W	8.42	41	44	LINSEED	GOOD DURABILITY; EXCELLENT AIR-DRY FILMS	AUTOMOTIVE REFINISHING ENAMELS
	COROC L-33-H4	49-51	AROMATIC	6-8	10-14	U-V	8.10	41	44	LINSEED	DRIES FAST; SAME AS L-33-H4 BUT DIFFERENT SOL.	AUTOMOTIVE REFINISHING ENAMELS
	COROC S-47-A2	60	XYLOL	5-7	2-5	X-Y	8.45	41	42	SOYA	EXCELLENT SPRAY-ABILITY; SAME AS L-33-H4 BUT SOYA OIL	AUTO AND TRUCK BODY ENAMELS; INDUSTRIAL BAKING ENAMELS
	COROC S-47-H4	49-51	AROMATIC	5-7	2-5	W-Y	8.15	41	42	SOYA	SAME AS L-33-H4 EXCEPT SOYA; BETTER COLOR RETENTION	WHEEL ENAMELS; COLORED BAKING ENAMELS
	COROC L-50-N6	54-56	MINERAL SPIRITS	8-10	5-10	Y-Z	7.78	32	55	LINSEED	EXCELLENT PIGMENT STABILITY	FARM AND IMPLEMENT ENAMELS; STRUCTURAL STEEL PAINT
	COROC L-53-A2	54-56	XYLOL	5-8	3-7	$Z-Z_2$	8.40	42	40	LINSEED	MINIMUM AIR DRY PERIOD; BAKE TO HARD FILM	RAPID AIR DRY AUTO ENAMEL; LACQUER PLASTICIZER
	COROC L-53-H4	49-51	AROMATIC	5-8	3-7	Z_3-Z_5	8.20	42	40	LINSEED	SAME AS L-53-A2 BUT DISSOLVED IN LOWER BOILING SOLVENT	WHEEL AND RIM ENAMEL; LACQUER PLASTICIZER
	COROC L-59-N2	44-46	V.M.&P.	6-8	4-9	T-U	7.30	34	53	LINSEED	POSITIVE DRYING UNDER ALL CONDITIONS	AUTO ENAMEL; SPRAY ENAMEL
	COROC L-59-N6	44-46	MINERAL SPIRITS	6-8	4-9	X-Y	7.60	35	53	LINSEED	EXCELLENT DRYING DURABLE FINISHES	IMPLEMENT ENAMEL; SIGN PAINTS
	COROC CS-327-A2	49-51	XYLOL	4-6	2-7	$Z-Z_1$	8.30	42	39	D.C.O. – SOYA	EXCELLENT ADHESION TO ALUMINUM AND ZINC DIE CASTING	APPLIANCE WHITE BAKING ENAMEL
	COROC RL-359-H4	49-51	AROMATIC	8-10	20-25	Z_1	8.10	34	–	LINSEED	FAST SOLVENT RELEASE; HIGH GASOLINE RESISTANCE	TOY AND DRUM ENAMELS
	COROC S-2123-A2	64-66	XYLOL	5-7	15-20	P-Q	8.42	37	44	SOYA	EXCELLENT FOR PIGMENT DISPERSION	PLASTICIZER FOR NITROCELLULOSE
	COROC S-3308-N6	59-61	MINERAL SPIRITS	6-8	4-8	Z_2-Z_3	7.86	31	57	SOYA	GOOD WATER AND WEATHER RESISTANCE	FUME PROOF WHITES; GLOSS VARNISH
	COROC Z3900-H7	49-51	HIGH BOILING AROMATIC	4-6	10-15	T-U	8.27	40	46	SAFFLOWER	ROLLER COATING APPLICATIONS	ROLLER COATING ENAMEL; OVERPRINT VARNISHES
	COROC L-4217-A2	59-61	XYLOL	6-8	10-14	X-Y	8.47	41	44	LINSEED	TOUGH HARD FILMS; EARLY TAPING	WHEEL AND RIM ENAMELS; AUTO AND TRUCK REFINISH ENAMEL
	COROC S-4305-N6	44-46	MINERAL SPIRITS	5-6	2-8	Z_2-Z_3	7.50	34	52	SOYA	HIGH GLOSS; GOOD STABILITY IN PIGMENTED ENAMELS	INDUSTRIAL ENAMELS; LOW COST
	COROC S-4357-A2-50	49-51	XYLOL	5-7	16-20	W-Y	8.30	39	40	SOYA	RAPID BAKING; GOOD COLOR AND GLOSS	AUTO BAKING ENAMEL; INDUS. BAKING ENAMEL
	COROC S-4700-A2-50	49-51	XYLOL	5-7	4-8	L-O	8.18	41	42	SOYA	GOOD PIGMENT DISPERSION	GASOLINE PUMP ENAMEL; INDUS. BAKING ENAMEL
	COROC S-4700-H4	49-51	AROMATIC	5-7	5-7	Z_2	8.11	41	42	SOYA	HIGH ADHESION IN LACQUERS	AUTO AND TRUCK REFINISHING ENAMELS
	COROC L-4910-N6	49-51	MINERAL SPIRITS	5-8	5-10	Y-Z	7.70	33	55	LINSEED	HIGH WATER RESISTANCE	MARINE ENAMELS; IMPLEMENT ENAMELS
	COROC S-6608-N6	49-51	MINERAL SPIRITS	8 max.	10 max.	Z_1-Z_3	7.65	35	50	SOYA	GOOD COLOR RETENTION	IMPLEMENT ENAMELS
	COROC B-6634-A2	49-51	XYLOL	5-6	3-9	Z_1-Z_3	8.38	44	36	DTFA.	EXCELLENT COLOR RETENTION	GASOLINE PUMPS; KITCHEN CABINETS
	COROC SL-6708-N6	49-51	MINERAL SPIRITS	5-7	6-8	X-Z	7.60	32	55	SOYA-LINSEED	GOOD DRY; HIGH GLOSS; DURABILITY	AUTOMOTIVE REFINISHING ENAMELS
	COROC SL-7636-N6	49-51	MINERAL SPIRITS	4-8	2-5	Z_4-Z_6	7.65	36	50	SOYA-LINSEED	EXCELLENT STABILITY AT HIGH VISCOSITY	INDUSTRIAL AIR DRY OR BAKING ENAMELS
	COROC L-8531-N2	44-46	V.M&P.	4-8	4-8	T-U	7.30	36-IPA	53	LINSEED	SAME AS L-8531-N6 BUT FASTER SET	RAPID DRY INDUSTRIAL PAINTS
	COROC L-8531-N6	44-46	MINERAL SPIRITS	6-8	4-8	$Y-Z_1$	7.55	36-IPA	53	LINSEED	GLOSS RETENTION GOOD	IMPLEMENT ENAMELS; AUTO ENAMELS
	COROC S-8539-N6	54-56	MINERAL SPIRITS	4-7	4-8	X-Z	7.65	30-IPA	59	SOYA	HARD DRYING GLOSSY ENAMELS	NON-YELLOWING WHITE ENAMELS
	COROC L-9299-N6	54-56	MINERAL SPIRITS	9 max.	8-15	$Z-Z_2$	7.75	35-IPA	57	LINSEED	HIGH SOLIDS BRUSHING ENAMELS	STRUCTURAL STEEL PAINT; ENAMEL UNDERCOAT

PROPERTIES OF ALKYD RESINS
(FOR USE ON METAL SURFACES)

MANUFACTURER	RESIN	% SOLIDS	SOLVENT	COLOR GARDNER 1933	ACID NO.	VISCOSITY GARDNER-HOLDT	POUNDS PER GALLON	% PHTHALIC ANHYDRIDE	% OIL	TYPE OF OIL	PROPERTIES	APPLICATIONS
ROHM & HAAS	DURAPLEX A-27	60	XYLOL	2-4	5-10	Z7	8.4	42	37	COTTONSEED	COLOR AND GLOSS RETENTION, HARDNESS, ADHESION, DURABILITY	WHITE BAKING FINISHES; CAN EXTERIORS
	DURAPLEX A-29	60	XYLOL	3-6	3-8	Z6	8.4	39	42	SOYA	FAST CURE; GLOSS, ALKALI RESISTANCE; HARDNESS, DURABILITY	FAST BAKING ENAMELS; NITROCELLULOSE LACQUERS
	DURAPLEX C-45 HV	60	M.T.	5-7	5-15	Z6	7.9	33	53	LINSEED	FAST SET AND DRY; GLOSS RETENTION; DURABILITY	AUTOMOTIVE, TRUCK AND BUS COATINGS
	DURAPLEX C-49	60	M.T.	4-7	8 max.	Z6	7.9	33	54	CASTOR	PIGMENT WETTING; COMPATIBILITY	METAL DECORATING; ROLLER COATING; SIGNS
	DURAPLEX C-55	50	M.T.	4 max.	8 max.	Z2	7.7	32	55	CASTOR	RESISTANCE TO TAPING; GOOD GLOSS	AUTOMOBILES, TRUCKS, SIGNS
	DURAPLEX C-55X	70	XYLOL	4 max.	8 max.	Z3	8.5	32	55	CASTOR	COMPATIBLE WITH CHLORINATED RUBBER.	FAST DRYING INDUSTRIAL FINISHES
	DURAPLEX C-57	60	M.T.	7 max.	8 max.	Z6+	7.9	32	55	SOYA	FAST AIR-DRY; GOOD COLOR, GLOSS, DURABILITY	FARM IMPLEMENT COATING; METAL DECORATING
	DURAPLEX C-58	60	M.T.	6 max.	8 max.	Z6+	7.9	32	55	SOYA	EXCELLENT FLOW, LEVELLING GLOSS, COLOR	METAL DECORATING AND BRUSHING ENAMELS
	DURAPLEX DX-656	50	M.T.	2-5	4-7	X	7.7	PRESENT	PRESENT	SOYA	FLEXIBILITY RETENTION, COLOR. SAG RESISTANT	COATINGS FOR METAL TUBING
	DURAPLEX AL-210C	100	—	DARK	10 max.	Z7	8.0	NONE	32	SOYA	FLEXIBILITY, GLOSS, DURABILITY; PIGMENT WETTING; COMPATIBILITY	CHASSIS BLACKS; SHORT OIL VARNISHES
	DURAPLEX AL-210H	100	—	DARK	6 max.	Z6+	8.0	NONE	NONE	—	SINCE IT CONTAINS NO OIL, DOES NOT AIR DRY	SIMILAR TO AL-210C
	DURAPLEX ND-77B	60	XYLOL	3 max.	4-10	Z6	8.6	47	33	COCONUT	COLOR AND GLOSS RETENTION; ACID AND ALKALI RESISTANT	NITROCELLULOSE LACQUERS; STOVES
	DURAPLEX ND-78	60	XYLOL	3 max.	6-10	Z2	8.5	43	33	COCONUT	HIGH ALKALI RESISTANCE; GOOD GLOSS, COLOR RETENTION	WASHING MACHINES; NITROCELLULOSE LACQUERS
	DURAPLEX ND-79	60	XYLOL	5 max.	6-10	Z3+	8.5	43	33	COCONUT	SIMILAR TO ND-78; COLOR NOT SO CLOSELY CONTROLLED AS ND-78	LOWER COST REPLACEMENT FOR ND-78
	AMBERLAC 80X	70	XYLOL	8-11	20-40	Z6	8.8	29	37	CASTOR	PRIMERS AND SURFACERS FOR METAL; ALCOHOL RESISTANT	COATINGS FOR METAL DECORATING
	AMBERLAC 292	48	AMSCO F80	3 max.	8-14	S-U	8.0	PRESENT	PRESENT	CASTOR	EXCELLENT FLOW, LEVELLING, HOT SLIP	APPLIANCE COATINGS
	AMBERLAC 292-G	50	AMSCO G	4 max.	14 max.	U-X	8.2	PRESENT	PRESENT	CASTOR	SIMILAR TO # 292-G	METAL DECORATING AND CLEAR FINISHING VARNISHES

quality control procedures that have resulted in much more uniform resins.

Economy. The raw materials from which alkyd resins are made are inexpensive and, consequently, the resins themselves are not expensive. Also, the paint manufacturer is afforded the use of resins conveniently packaged and ready to use, thus affording him even greater economy.

Manufacturers of Alkyd Resins

Three charts were presented in the preceding section of this article describing the properties of alkyd resins for use on metallic surfaces, made by Allied Chemical Corporation, American Cyanamid Company, and Jones Dabney. In the accompanying charts will be found the corresponding data for similar alkyd resins produced by:

France, Campbell and Darling, Inc., Kenilworth, New Jersey

Cook Paint and Varnish Company, Coroc Resin Division, Kansas City, Mo.

Rohm and Haas Company, Resinous Products Division, Philadelphia 5, Pa.

References

1. A Concise Guide to Plastics. By Herbert R. Simonds. Published in 1957 by the Reinhold Publishing Company, New York, N. Y.
2. Literature supplied through the courtesy of the firms mentioned in this article.

THE ELECTROCHEMICAL SOCIETY

An exceptionally large number of papers on various phases of electrodeposition were presented during the Detroit, Mich., meeting of *The Electrochemical Society*, Oct. 1-5, 1961. Sessions were held both in the morning and afternoon on Monday, Tuesday, and Wednesday, with a final session on Thursday morning. Presiding at these were *D. Trivich, Seward Beacom, D. G. Foulke, D. R. Turner, D. C. Wendell, Jr., Herman Koretsky*, and *Abner Brenner*. Following are abstracts of the papers of interest to electroplaters:

The Role of Addition Agents in Bright Nickel Plating

By H. Brown, (The Udylite Research Corp., Warren, Mich.)

The structure of various organic compounds used in aqueous electroplating baths is related to their functions in the baths. Principal attention is given to bright nickel plating and the effect on brightness and leveling of sulfonic, carbonyl, and amino groups, multiple bond carbon to carbon and carbon to nitrogen linkages. Possible mechanisms are considered for brightening and leveling based on adsorption and hydrogenation reactions on nickel as catalyst.

Kinetics of Electrode Processes in Relation to Electrodeposition

By B. E. Conway (Dept. of Chemistry, University of Ottawa, Ottawa, Ontario, Canada)

Following a brief introduction of the basic concepts in electrode kinetics, the elementary processes in electrodeposition are reviewed, including diffusion, adsorption of ions in the double layer, Faradaic ion transfer at the metal interface, surface diffusion of ad-species, electrochemical crystal building steps, and the role of dislocations. Methods for studying ion transfer and diffusion at electrodes are given and the results of kinetic measurements in selected systems (Hg, Cu, Ag) are given. Possible rate-determining steps are discussed as are some fundamental factors determining the role of adsorption of additives at electrodes during electrodeposition.

Crystal Growth and the Structure of Electrodeposits

By S. C. Barnes, J. P. G. Farr, and H. J. Pick (Joseph Lucas Lab., Dept. of Industrial Metallurgy, The University, Birmingham 15, England)

A comparison is made of published observations on the topography of growing electrodeposits and discussion given of the attempts made to correlate the structures produced with the state of the substrate and electrochemical parameters. Attention is drawn to the application of relaxation techniques. The effects of addition agents on crystal growth and the electrochemical reactions at a cathode are considered; the authors have summarized briefly their own experiences and compare these where possible with other published work.

Theories of Addition Agents in Electrodeposition

By Eugenio Bertorelle (Preside Instituto Chimico, RHO, Milan, Italy)

Various aspects of the theories of addition agents and their influence on the mechanism of electrodeposition are examined fully and discussed. Particular attention is paid to the theory of inhibition, of complex formation and adsorption; the relation with experimentally observable quantities such as cathode polarization, co-deposition of nonmetallic material deriving from addition agents or their decomposition products, is discussed. Some observations on the electrode reactions of addition agents are reported, and the different features concerning some of the industrially important metals are also mentioned.

Effects of Addition Agents on Physical and Mechanical Properties of Electrodeposits

By H. J. Read (Dept. of Metallurgy, Pennsylvania State University, University Park, Pa.)

The physical properties to be discussed are density, magnetic behavior, and electrical resistivity. Emphasis is placed on the mechanical properties of hardness, tensile strength, ductility, and internal stress, but some attention is given to modulus of elasticity and to fatigue strength. Instances where addition agents are added intentionally to alter properties have been separated, so far as possible, from those cases where the addition agent serves another purpose, such as a brightener, but affects the physical or mechanical properties at the same time.

X-Ray Determination of Residual Stresses in Electrodeposited Coatings

By G. W. Bush (Research and Development Dept., National Steel Corp., Weirton, W. Va.) and H. J. Read (Dept. of Metallurgy, The Pennsylvania State University, University Park, Pa.)

Experimental and mathematical procedures were developed and tested for x-ray determination of stress in deposits from data secured with an x-ray diffractometer. The effects of deposit thickness, variations in elastic modulus, and stresses owing to differential thermal expansion between deposit and basis metal have been evaluated. Work on nickel deposits showed stress can be evaluated to $\pm$4000-6000 psi and that stress was uniformly distributed over the area irradiated by the x-ray beam.

Electron Microscopic Observation of the Structure of Electroplated Nickel

By R. Weil and H. C. Cook (Dept. of Metallurgy, Stevens Institute of Technology, Hoboken, N. J.)

Electron microscopy using thin films and replicas was employed to study the nature of various structural features due to addition agents, observed in electroplated nickel. The growth mechanisms were investigated by viewing the structure at successive stages in the deposition process. Selected-area diffraction was used to measure grain sizes and orientations. By observing samples annealed at several temperatures, the locations of foreign substances and their influences on the structure were determined.

The Influence of Adsorbed Material on the Growth of the Metallic Lattice

By T. P. Hoar (Dept. of Metallurgy, University of Cambridge, Cambridge, England)

Addition agents, whether used for brightening, leveling, refining of grain size, or reduction of tensile stress in electrodeposits, are commonly held to act by "adsorption." The present paper attempts to discriminate between different kinds of adsorption according to the lattice structure and electrochemical characteristics of the metal being deposited, and the size, shape, and polarizability of the molecule being adsorbed. Empirical knowledge of the various kinds of addition agents can thereby be partially codified and explained. Outstanding problems in the field are reviewed briefly.

Evidence for the Deposition of Very Complex Cations

By F. C. Mathers (Chemistry Dept., Indiana University, Bloomington, Ind.)

This paper gives experimental, but circumstantial, evidence that everything in the bath that has an effect on the nature and composition of the deposited metal must be in the bath in the form of complex cations, the metal itself, the acid ion, addition agents, and other things like "conducting salts," etc. What other explanation is there for the large quantities of tartaric acid and some iron in a silver deposit from the nitrate bath containing ferric nitrate and tartaric acid? The deposition potential of iron is so far from silver that it would seem impossible to deposit any iron otherwise. It is well known that there are many complex cations such as $CdCl^+$; therefore, it is logical that all metals and all acids form similar complexes. Ions are now known to be highly solvated so why cannot all the rest of the things in a bath be a part of the cations? How can the acid parts of the various salts get to the cathodes if they are not a part of the cations? Why is the deposit of tin from the fluoride bath always rough and crystalline but smooth from a similar sulfate bath? If bismuth chloride will be dissolved in molten metallic bismuth why not expect cathode deposits to be solutions of the things in the complex cations where the conditions for forming a solution in the metal could be better than when using molten materials?

The Growth of Zinc and Other Electrodeposits

By J. M. Keen and J. P. G. Farr (Joseph Lucas Lab., Dept. of Industrial Metallurgy, The University, Birmingham 15, England)

Zinc has been electroplated from acid sulfate solutions onto zinc polycrystalline and single crystalline cathodes, and onto copper single crystal surfaces. The surface features developed are described and are related to those observed on copper electrodeposits in terms of the supposed atomic structure of the substrate surface, of the bulk crystal structure of the deposited metal, and of the growth process. Some experiments on the deposition of lead, cadmium and iron are also described and discussed.

The Effect of Thio-Compounds on the Structure of Copper Electrodeposits

By S. C. Barnes (Dept. of Industrial Metallurgy, The University, Birmingham, England)

Active addition agents in acid copper plating solutions can be divided into two groups: those which increase cathodic overvoltage, and those which lower it. Thio-compounds are in the latter group. Their effects on the characteristics of epitaxial deposits formed on single crystal electrodes have been studied, in conjunction with measurements of cathodic polarization. It is found that pronounced habit changes occur when the addition agents are present in amounts sufficient to affect the overvoltage.

Rotating Disk Electrode Techniques for the Study of Addition Agents

By S. E. Beacom and R. N. Hollyer, Jr. (Research Labs., General Motors Corp., 12 Mile and Mound Rds., Warren, Mich.)

The rotating disk electrode is used as a tool to study the effect of thiourea on the electrodeposition process. Rotating disk theory has been verified for deposition of copper from cupric sulfate solutions in the presence of certain ratios of cupric to inert electrolyte ions. The addition of thiourea produces measurable effects on the several parameters considered. Possible explanations for the role of thiourea are discussed.

The Effect of Some Addition Agents on the Kinetics of Copper Electrodeposition from a Sulfate Solution, I. Cathode Potential-Current Density Relation

By D. R. Turner and G. R. Johnson (Bell Telephone Labs., Inc., Murray Hill, N. J.)

Thiourea, l-cystine, glycine, gelatin, and dextrin were used as addition agents in copper plating from a sulfate solution. Additions of dextrin up to 0.1 g./l. have no effect on the kinetics of copper deposition. All the other addition agents inhibit the rate of copper deposition, and each one has a different behavior. Dextrin enhances the inhibiting effect of thiourea during copper plating. There is evidence that thiourea forms a stable complex with cuprous ions in the plating bath.

The Effect of Some Addition Agents on the Kinetics of Copper Electrodeposition from a Sulfate Solution, II. Rotating Disk Electrode Experiments

By G. R. Johnson and D. R. Turner (Bell Telephone Labs., Inc., Murray Hill, N. J.)

A rotating disk electrode technique has been used to study the effect of thiourea, l-cystine, glycine, gelatin, and dextrin on the kinetics of copper electrodeposition from a sulfate solution. The results indicate that some addition agents function solely by means of an adsorption phenomenon whereas others involve an electrochemical reduction of either the addition agent or a cuprous ion-addition agent complex. The fraction of the total current consumed in reducing the addition agent, or a cuprous ion-addition agent complex, can be determined at any given cathode potential.

Some Structural Aspects of Nickel Electroplates

By L. P. Bicelli and G. Serravalle (Laboratori di Elettrochimica di Chimica Fisica E di Metallurgia del Politecnico di Milano, Piazza Leonardo da Vinci 32, Milan 132, Italy)

Cathodic behavior of nickel polycrystalline and single crystal electrodes, oriented following the (100), (110), and (111) planes, has been investigated in perchlorate and sulfamate baths. The crystallization process of definite thickness deposits has been investigated particularly. X-rays were used to determine the basis and bath influence on the preferred orientations of the deposits, while the kinectic aspects of the electrodeposition processes are studied by means of current efficiency and overvoltage measurements. Some correlations between crystallographic results and overvoltage measurements have been established.

The Effect of Addition Agents on the Structure and Physical Properties of Gold Electrodeposits

By D. G. Foulke (Sel-Rex Corp., Nutley, N. J.)

Bright gold processes in common use differ from the nonprecious metal baths in that the emphasis has been on the codeposition of metals with the gold, rather than on the use of organic addition agents. There are potent reasons for this divergent trend as compared to nickel and copper baths as can be shown by photomicrographs before and after heat treatment. Photomicrographs and x-ray diffractograms have indicated the structure of typical bright gold deposits now being plated and they have been related to the deposit analysis.

Radiotracer Studies of the Uptake of Sulfur from Brightener Compounds by Copper and Nickel

By J. J. Hoekstra (present address: Dow Chemical Co., Midland, Mich.) and Dan Trivich (Dept. of Chemistry, Wayne State University, Detroit 2, Mich.)

The uptake of S-35 from thiourea by single crystal spheres of copper and nickel was found to increase with increasing concentration of thiourea in the solution, but showed no preference for any particular crystal face. Allyl sulfonate labelled with S-35 was not taken up by nickel under simple immersion, but was included under condition of nickel electrodeposition. Dissolution of the electrodeposits caused the S-35 to be evolved as H_2S as shown by quantitative analysis and x-ray diffraction. (This work was made possible by a fellowship from the General Motors Research Labs. to J.J.H.)

A Study of Laminations in Bright Nickel Electrodeposits

By Nicholas Vanderkooi (present address: General Chemical Div. of Allied Chemical Corp., P. O. Box 405, Morristown, N. J.) and Dan Trivich (Dept. of Chemistry, Wayne State University, Detroit 2, Mich.)

The laminated structure of bright nickel electrodeposits was studied as a function of current density, pH, cathode

shape, and type and concentrations of brighteners, especially the system allyl sulfonate, N-allyl quinaldinium bromide. First-class brighteners (sulfonates) produce laminated electrodeposits; second-class brighteners alone do not, but they do enhance the laminated structure when used with the first-class type. On rough cathodes, equal numbers of laminations are produced on peaks and valleys. The significance of this in leveling is discussed. (This work was made possible by a fellowship from the General Motors Research Labs. to N. V.)

The Effects of Organic Additives on the Kinetics of Tin Deposition

By Ernest Yeager, Frank Hovarka, and Stuart Meibuhr (present address: Applied Research Lab., U.S. Steel Corp., Monroeville, Pa.), Dept. of Chemistry, Western Reserve University, Cleveland 6, Ohio.

The electrode kinetics of tin deposition from simple acid solutions containing various organic substances have been studied by the measurement of the cathodic steady-state polarization as a function of current density. The experimental variables included temperature, concentration of stannous ion, concentration and type of addition agent and type of cathode, pure solid tin and liquid tin amalgam. The results indicate that the rate-determining step is charge transfer.

Experimental Observations on the Behavior of Addition Agents in Bright Nickel Plating

By I. R. Bellobono and Eugenio Bertorelle (Istituto Chimico, Rho, Milan, Italy.)

The cathode adsorption of addition agents plays a fundamental part in the studies on the mechanism of bright plating, of leveling and similar phenomena. Using polarization measurements and the analytical determination of addition agents and their decomposition products at various electrodeposition times, it is possible to obtain important information about the relationship between adsorption and cathode polarization as well as about the influence of the decomposition products which may be present in solution. The experimental researches carried on examine these particular aspects of bright nickel electrodeposition in the presence of addition agents which behave as primary or secondary brighteners. An analytical method which makes use of a spectrophotometric technique for the determination of brighteners in electroplating solutions is also fully described.

Effect of Addition Agents on the Formation of the Bright Deposit from Zn-, Cd-, and Ag-Cyanide Baths

By Tadao Hayashi and Takeo Ishida (Dept. of Applied Chemistry, University of Osaka Prefecture, Sakai City, Osaka, Japan)

Study was made of the effect of addition agents on the formation of bright Zn-, Cd-, and Ag-electrodeposits from cyanide baths. Cathode polarization measurements were carried out in the presence of various addition agents, and the deposits obtained from these baths were analyzed by the electron diffraction method and also by photomicrography in order to elucidate the characteristics of the crystal structure with respect to the formation of the bright deposit.

Mechanism of Addition Agent Reaction in Bright and Leveling Nickel Deposition as Studied with Radioactively Tagged Compounds

By B. J. Riley and S. E. Beacom (Research Labs., General Motors Corp., Warren, Mich.)

Radioactively tagged sodium allyl sulfonate and N-allyl quinaldinium bromide have been used in a continuing study of the leveling phenomenon associated with the deposition of bright nickel. Further evidence has been obtained to support the previously stated concept of addition agent interaction which accounts for the synergistic effect in leveling brought about by combinations of addition agents.

Effect of Organic Additives on the Hydrogen Absorbed by Iron

By T. C. Franklin and Fujio Matsuda (Baylor University, Waco, Texas)

A study was made of the effect of organic additives on the absorption of electrolytically generated hydrogen by small iron wires and the resultant effect on the embrittlement of the iron. A polarographic technique was used to analyze for the hydrogen, and the embrittlement of iron was studied by a bend test. A linear relationship was observed between the amount of hydrogen absorbed and the embrittlement.

Bismuth Electroplating

By J. G. Beach (Battelle Memorial Institute, 505 King Ave., Columbus 1, Ohio)

Bismuth electrodeposits from baths containing "addition agents" were unsatisfactory toward answering an engineering need for a bismuth-nickel alloy coating. The desired results that were expected from the use of addition agents were obtained, and cogent problems were resolved by the use of periodic reverse-current plating.

A Cell for Plating Corrosion Test Panels with Varying Current Densities

By A. A. Johnson (Metal and Thermit Corp., 1700 E. Nine Mile Rd., Detroit 20, Mich.)

To enable current density and thickness variations of the magnitude encountered on plated parts to be obtained on the standard flat 4 x 6 in. corrosion test panel, a new laboratory plating cell was designed. The use of the cell for corrosion testing is illustrated, and current density distribution profiles and other cell characteristics are given. The influence of current density and thickness of decorative chromium plate on its crack pattern and on the resulting corrosion protection is discussed.

Introduction to Magnetic Phenomena of Soft Magnetic Thin Films

By Rexford Alexander (Burroughs Lab. Research Center, Burroughs Corp., Paoli, Pa.)

A simple model of the magnetic properties of ferromagnetic materials is presented for the description of terms of signifiance in magnetic thin films work. The anisotropy properties and the dynamics of thin films remagnetization are stressed.

A Method of Preparing Iron-Nickel Films and Some of Their Properties

By P. Kuttner and D. Clemson (Electronic Instruments Div., Burroughs Corp., Philadelphia, Pa.)

Films of 1000A thickness with excellent anisotropy (H_K = 1.2 oe), and coercivity of 0.5 oe have been made reproducibly from an aqueous bath of nickel and iron sulfate with addition agents. Plating is done in a magnetic field. The film composition is 95% Ni, 5% Fe. Without addition agents, the composition and magnetic properties of the films change. However, the magnetic properties cannot be explained on the basis of composition alone.

Stress Reducing Organic Additives in the Sulfate-Chloride Bath for Iron-Nickel Deposition

By I. W. Wolf (General Electric Corp., Syracuse, N. Y.)

The sulfate-chloride bath has been used for the deposition of magnetic codeposits of nickel and iron. Of special interest have been the very thin films (approximately 1000A) used for computer memory elements. Stress reduction in these codeposits was achieved by adding saccharin to the solution. However, the role of saccharin was not well understood. In this work, various organic molecules were added to baths in place of saccharin. Few were capable of reducing stress at all detectably and none as well as saccharin. There is strong evidence of a need for a very specific molecular form for stress reduction in this system.

A Discussion of Electrodeposited, Cylindrical Film Memory Elements

By T. R. Long (Bell Telephone Labs., Inc., Murray Hill, N. J.)

A progress report is presented on a program of electrodepositing Ni-Fe films on a wire substrate for use in a nondestructive, cyclindrical film memory. Permalloy films with

uniaxial anisotropy are continuously deposited on a 5-mil diameter substrate. Experimental data on the process as well as on the magnetic character of the material are presented. The continuous nature of the process introduces some unique problems of control in the deposition of an alloy whose characteristics are strongly dependent on composition. These problems as well as some compensating advantages are discussed.

Magnetic Properties of a 97Fe-3Ni Thin Film Electroplate

By H. J. White and A. J. Kolk (Electronics Div., National Cash Register Co., Hawthorne, Calif.)

The NCR "Rod" thin film computer memory element employs a 97Fe3Ni alloy deposited on a silvered-glass cane or a BeCu wire of approximately 10 mil diameter. The physical condition of the surface of the silver or the BeCu has been found to be of great importance in determining the magnetic properties of the overplate. The effects of current density, pH, plate thickness, and magnetic field applied during plating have been investigated. Unlike permalloy, the magnetic properties were not found to be sensitive to minor variations in alloy composition and were only slightly affected by the level of stress in the plate. The high-speed magnetic switching coefficient of the "Rod" is of a magnitude normally associated with the incoherent rotation mechanism.

Electrodeposited Magnetic Films for Computer Memories by Jet-Cell Plating in High Magnetic Fields

By J. H. Glaser and W. W. Richardson (Philco Corp., Willow Grove, Pa.)

A new method has been developed for plating magnetic films by jet-cell plating technique (Philco propr.) which will allow monitoring of film properties during plating process and terminating operation at optimum condition. The technique allows plating in very high magnetic fields which results in dense films with high output and very good anisotropy. Individual monitored spot plating *vs* etched film-matrix is evaluated.

An Introduction to the Meaning of Fundamental Magnetic Terms and Their Significance in Magnetic Recording

By G. Bate (Product Development Lab., Data Systems Div., International Business Machines Corp., Poughkeepsie, N. Y.)

The paper covers terms used in describing the magnetic properties of the two principal types of magnetic memory materials. Those terms include saturation magnetization, remanence, squareness, coercive force, etc., and the physical significance of the parameters in the recording process is discussed.

Magnetic Properties of Ferromagnetic Metals and Their Alloys Electrodeposited from Sulfamate Solutions

By V. Zentner (Hughes Aircraft Co., Culver City, Calif.)

The magnetic properties of nickel, iron, and cobalt electrodeposited from sulfamate solutions and their change with conditions of deposition were determined. Alloys of nickel-iron, cobalt-iron, and cobalt-nickel plated from sulfamate systems with systematic variations in bath composition were prepared. The dependence of alloy composition on electrodeposition variables was investigated and the relation between magnetic properties, alloy composition, and crystal structure of the deposits determined.

Magnetic Electrodeposits of Cobalt-Phosphorus

By J. S. Sallo and J. M. Carr (Honeywell Research Center, Hopkins, Minn.)

Electrodeposited films of cobalt-phosphorus have been prepared having coercivities ranging from less than 50 oe to more than 1500 oe. The magnetic properties are independent of the substrate. Chemical composition, crystallographic orientation, and electron microscopy including Bitter Pattern studies are related to the observed coercive force. Conditions for preparing materials within this range of coercivity, including materials with stepped hysteresis loops, are described and related to the chemistry of the system.

The Influence of Internal Stress on the Coercive Force of Thick Films of Cobalt and Nickel Electrodeposits

By R. D. Fisher (Physical Research Dept., National Cash Register Co., Dayton 9, Ohio)

Nickel and cobalt electrodeposits were prepared at low current density (15 ASF) from simple aqueous solution. The influence of the metal salt ($CoCl_2$ or $NiCl_2$) and saccharin solution concentration on the average stress and microstructure of the cobalt and nickel electrodeposits was investigated in conjunction with measurements of their magnetic properties. The coercive force and stress of the nickel and cobalt electrodeposits were determined and compared at thickness values of approximately 5μ. The results indicate that in certain instances the coercive force of the deposits can be directly correlated with the residual stress.

Further Studies of the Transition Region of a Cobalt Sulfate Electrolyte

By H. F. Quinn (Federal Systems Div., International Business Machines Corp., Owego, N. Y.)

In conjunction with Croll, the author has previously reported the occurence of a distinct change in the texture of cobalt electrodeposited from a dilute sulfate bath. With all other parameters held constant, this transition was found to occur in the vicinity of *p*H 4. On repeating the experiments at smaller *p*H increments it has been observed that the texture (and the associated magnetic properties) changes smoothly throughout a transition region from 3.8 to 4.8 *p*H units. It has been shown that the change in coercivity of the plating is not directly associated with the textural changes. The nature of the alteration in the crystal growth process at the cathode is considered in terms of the theory of Willman and others. In particular, it is shown that the type and surface finish of the substrate are not significant controlling factors in the growth process.

An Investigation of the Crystal Structure and Magnetic Properties of Cobalt Nickel Platings from a Combination Sulfate/Chloride Bath with Saccharin as an Additive

By H. F. Quinn, M. Sulich, and J. Manley (Federal Systems Div., International Business Machines Corp., Owego, N. Y.)

In order to obtain a specific recording characteristic and to provide data for process control we have investigated the crystal texture and magnetic properties of platings prepared in a cobalt chloride/nickel sulfate bath containing saccharin as the additive agent. The composition, texture, and magnetic properties of the platings as a function of varying a-c/d-c ratio for each of 4 pH values are reported.

A Method for the Study of Nucleation of Thin Films

By A. E. Cahill (General Electric Corp., Syracuse, N. Y.)

Measurements of hydrogen overvoltage are used to determine what fraction of a surface consists of gold and what fraction consists of nickel-iron. When very thin layers of nickel-iron have been electroplated on a gold substrate, it is possible by this means to determine to what extent the nickel-iron is continuous. When the nickel-iron deposits in islands, the hydrogen overvoltage indicates that the solution is in contact with both gold and nickel-iron.

Magnetic Properties of Electroless Cobalt Films and Their Application in High Density Digital Recording

By M. A. Foley (Burroughs Lab., Research Center, Burroughs Corp., Paoli, Pa.)

Electroless cobalt has been deposited on conductive and nonconductive substrates and the magnetic properties evaluated in respect to thickness, coercive force, and remanence. A coercivity range from 40-500 oe can be obtained by varying the plating conditions. The influence of various substrates on the magnetic properties together with bath *p*H, agitation, and rate of deposition has been determined. Crystallographic studies of films of low and high coercivity have been performed. The dynamic evaluation of thin magnetic films (2—100 μin.) in high density recording is discussed.

(*Continued on page* 70)

Surface Preparation and Painting Magnesium Alloys

By Lester F. Spencer, *Cleveland, Ohio*

This is the third and final installment of the series on magnesium alloys. Parts I and II appeared in the September and October issues respectively.—Ed.

A COMPLICATING factor, characteristic of magnesium surfaces, is that it will react with moisture to form a thin layer of magnesium hydroxide. Even though this film may be of microscopic dimensions, a sufficient surface alkalinity will be present to cause difficulty if the proper type primer is not chosen. Thus, those paints that are sensitive to alkali may become quite brittle, even after relatively short periods of service.

Another factor is the imperfect surface condition, particularly that obtained on a magnesium casting. Although this roughened surface will encourage mechanical keying of the paint film, there are also many flaws that the paint film will bridge. As a result, moisture will be drawn to these tiny cavities by capillary attraction to form corrosion products and, in due time, pinholes or actual lifting of the paint film will result.

Thus, in selection of a paint system for magnesium-base alloys, whether it will serve to provide decorative appeal or a protective barrier against corrosion, one must first observe the factor of design. There is no paint film that will give adequate protection on sharp edges or corners. In addition, the contour of the part should be designed to avoid cavities or hollows that may permit an accumulation of corrosion products.

The second factor is that of surface preparation. This will include those operations of cleaning and pickling that usually precede any of the chemical treatments commercially available. Since a good deal of difficulty in a paint system begins at the interface of the metal surface and the primer, the type primer chosen is of tremendous importance; the basic characteristics desired would include chemical compatability, adhesion, and resistance to both moisture and corrosion.

The final factor is the selection of a finish coat; the criteria for selection being based on (a) chemical compatability with the primer, (b) ability to provide the necessary protection under the rated conditions of service, and (c) adaptability to both the conditions and the finishing equipment available.

A fact that is well recognized is that paint adhesion will vary with the humidity that exists at the time of application. In addition, the absorption and occlusion of gases and vapors from the surrounding atmosphere will also cause a variation in the quality of the coating. To obtain consistent high quality and uniformity of coating, it is not surprising that the use of air conditioning is worthy of consideration for industrial usage.

Chemical Treatments

The need for a foundation treatment is well recognized, and the various chemical conversion coatings are produced in baths that contain dichromates, mixtures of dichromates and other oxy-acids, such as sulfates, phosphates, and nitrates. Those chemical treatments that involve a simple immersion produce a relatively thin film and, although they may adequately serve as a foundation coating for a paint system, do not offer much resistance to physical damage. Attempts to obtain a harder and a thicker film by chemical immersion technique has met with little success.[12]

To obtain a more durable film, it is necessary to use an electrolytic anodizing treatment; the relatively thick, dense, and adherent coating will offer the ultimate in paint adhesion, corrosion protection and, where desired, abrasion resistance. These electrochemical treatments are performed in what may be classified conveniently as either a low voltage or a high voltage bath. The low voltage bath is usually a simple solution in which the electrochemical action is obtained by an anion in the bath to form either an oxide or a hydroxide coating on the magnesium surface. When compared to a high voltage bath, the low voltage bath produces a deposit that is thin, of greater flexibility, and of smoother texture. The high voltage bath offers maximum protection, particularly, to an air-dry paint system. It is characterized by a hard, wear-resistant film that has little, if any, flexibility. The hard and brittle nature of the high voltage coatings is a distinct disadvantage, since spalling may occur under conditions of shock and/or flexure.

Conversion Coatings Obtained by Immersion

The *chrome pickle* is the least expensive and most commonly used formulation. However, since a pronounced etching is obtained, it is not recommended for machined surfaces. An interesting property is the dependency of color on both the age and nitric acid content of the bath. A fresh solution produces a matte gray to yellow-red iridescence and a surface that has a micro-network or pebbled effect, this being

the preferred as a paint base. As the solution ages or increases in nitric acid content, a relatively smooth, bright brassy coating is obtained, and is accompanied by inferior paint adhesion qualities.

As is indicated in Table 6, the formulation will vary with the product type. Proper adherence to recommended practice is essential. Thus non-adhering, powdery coatings may be obtained when the solution is near exhaustion, by an undue delay in the final rinse, by neglecting to follow recommended cleaning

TABLE 5

Chemical Treatments for Magnesium Alloys Suitable as a Paint Base

Dow No.	Treatment Name	Type	Treatment Used on	Appearance	Uses	Remarks
1	Chrome pickle	Chemical	All alloys	Matte gray to yellow-red	General purpose treatment for protection during shipment and storage. Good paint base.	Inexpensive, immersion treatment. Etching action causes slight dimensional loss.
7	Dichromate	Chemical	Aluminum-containing alloys, EK33 & ZK60. Cannot be used on Ml, EK30 and EK41A	Brown	Provides best combination of paint base and protective qualities.	Does not materially affect dimensions.
9	Galvanic anodize	Electrochemical	All alloys	Black	Used on Ml and other non-aluminum containing alloys not treatable in #7.	Requires galvanic couple between work and steel tank or steel cathode plates.
10	Sealed chrome pickle	Chemical	All alloys	Matte gray to yellow-red	Alternate for #7 when dimensional loss can be tolerated.	Better protection than #1, due to 30 min. in boiling dichromate solution.
12	Caustic anodize	Electrochemical	All alloys	Light shades of gray and tan	Specialty treatment, combining decorative finish with good abrasion and protective value.	Can be dyed. Neutralizing seal gives it paint base qualities, equal to #7 treatment.
14	A.C. anodic	Electrochemical	All alloys	Light gray to white	Good abrasion resistance. Can be painted when given a neutralizing seal. Cannot be dyed.	Will cover flow marks on die-cast surfaces. May be waxed to prevent smudging.
17	A.C./D.C. anodic	Electrochemical	All alloys	Light to dark green	Protective and decorative finish.	Most abrasion resistant, best paint base.
—	Manodyz	Electrochemical	All alloys including those with cerium & zirconium	Gray	Good protective coating and paint base.	Either a.c. or d.c. rated superior to dichromate finishes.
—	HAE	Electrochemical	All alloys including those with zirconium, thorium, & rare earths	Light tan to brown	Protective and decorative finishes. Used as paint base.	Excellent abrasion resistance in heavier thicknesses, excellent corrosion protection when properly sealed.
—	RAE	Chemical	All alloys	Brown	Good paint base.	Relatively insensitive to temperature, pH and chromium/sulfate ratio.
—	CR-22	Electrochemical	All alloys	Light green to black	Protective and decorative finish.	Excellent corrosion resistance, especially when sealed.

TABLE 6

Solution Compositions and Operating Data for Chemical Treatments

	Sodium dichromate, oz./gal.	Nitric acid (sp. gr. 1.42), fl. oz./gal.	Sodium, potassium or ammonium fluoride, oz./gal.	Magnesium or calcium fluoride, oz./gal.	Ammonium sulfate, oz./gal.	Ammonium hydroxide, fl. oz./gal.	Operating temperature, °F.	Recommended time, min.	Comments
Chrome pickle wrought products	24	24	—	—	—	—	70 to 90	0.5 to 2.0	These baths remove 0.0006″ per surface. Stainless steel, glass, ceramic, vinyl, or synthetic rubber-lined tanks.
Permanent mold, sand, & die castings	24	16 to 24	2	—	—	—	70 to 90	0.5 to 2.0	Type 316 stainless for tanks and racks, phosphor bronze for racks. Die-cast cycle — 30 sec. in hot water followed by 10 sec. dip at 120-140°F.
Dichromate	16 to 24	—	—	0.33	—	—	180 to 210	30	Calcium or magnesium fluoride assures film formation. Steel tank. Activation treatment required.
Galvanic anodize	4	—	—	—	4	0.33	120 to 140	10 to 30	Steel tank. 10 amp./ft.^{2} maximum of anode area. Monel, stainless, or phosphor bronze racks.
Sealed chrome pickle									Combination of a chrome pickle and the dichromate boil.

procedures prior to immersion or by the use of an operating temperature that is higher than recommended.

The *dichromate* bath is used where dimensional loss cannot be tolerated. A prior activation treatment is essential, involving a 1 to 5 minute immersion in a hydrofluoric acid solution that is operated at 70 to 90°F. Where the assembly contains aluminum inserts, it is necessary to use an alternate bath containing about 7 oz./gal. sodium, potassium, and/or ammonium acid fluoride, a 15 minute immersion at a temperature of 70 to 90°F. being recommended. A standard immersion treatment in a hot dichromate bath is the next operation, followed by cold water rinsing and a hot water dip to facilitate drying.

The *sealed chrome pickle* involves immersion in a chrome pickle bath, followed by a 30 minute immersion in a sodium dichromate boil. The protective quality of this bath is equivalent to that obtained in the dichromate bath. The precautions stated for the chrome pickle applies equally well to this procedure.

Although the *galvanic anodize* solution is used to obtain a decorative black coating for interior usage, its primary function is that of a paint base. The galvanic action is obtained by utilizing the relatively high potential difference between the magnesium and the tank or cathode material employed. Usually 70 ampere-minutes per square foot of anode area is required to secure a uniform coating. The procedure involves pre-treatment in either an aqueous solution of hydrofluoric acid or an acid fluoride bath, as given for the dichromate treatment, a 10 to 30 minute immersion in the anodizing solution, and then a cold and hot water rinse.

A British development of a dichromate bath for magnesium alloys is known as the RAE treatment.[15] The treatment, which consists of a 30 minute immersion in a hot solution containing potassium dichromate, ammonium dichromate, ammonium sulfate, and ammonia, is reputed to be applicable to all magnesium alloys, and also to be relatively insensitive to variations in temperature, pH, and chromate/sulfate ratio. Its performance as a paint base is good.[17]

As is indicated in the above solution types, the passivating effect of the chromate ion is used to good advantage. According to Loose[16] the films formed are normally amorphous mixtures composed largely of hydrated chromium and magnesium oxides. When alloying elements such as aluminum, zinc, manganese, etc., are present within the base alloy, they are also found in relatively large amounts in the films formed. When sulfates, phosphates, or nitrates are added to the bath composition, they too are found in the coating.

The performance of a conversion coating on magnesium, as obtained by any of the above immersion treatments, is depended upon the alloy composition, the care taken in cycling through those operational steps of cleaning, activating, coating, etc., as well as

observing good practice in solution control, and the service environment. It is emphasized that the immersion treatments described have little value in increasing wear resistance, but serve their purpose in providing increased adhesion for subsequent painting.

Loose evaluated the protective surface treatment on a controlled and uncontrolled purity wrought alloy, ASTM AZ31X; the solutions employed were the chrome pickle, sealed chrome pickle, the dichromate and the galvanic anodize. An alternate immersion test was used, and the test medium was a 3 per cent sodium chloride solution. On the controlled purity alloy, the type of protective treatment had little influence on the corrosion rate. On this same alloy, where the impurities were beyond the tolerance limits, the dichromated specimen showed the least attack, while both the chrome pickle and the sealed chrome pickle showed the poorest performance.

Loose indicated the importance of the hydrofluoric acid treatment, used in both the dichromate and galvanic anodic treatments, in removing cathodic impurities that normally would cause corrosion in accelerating media. The MgF_2 film formed on the magnesium surface also appears to be important in catalyzing or promoting the chromate film formation.

A similar test was performed on a cast alloy, ASTM AZ92. Although the iron content of this alloy is well above the tolerance limit, the zinc present modifies the effect of the cathodic impurities and greatly reduces the rate of corrosion of the base alloy. The least effective treatment was the chrome pickle, while both the sealed chrome pickle and the dichromate were equal in their protective qualities.

Upon painting treated panels, the immersion test indicated that the chrome pickle, sealed chrome pickle, and the galvanic anodize exhibited good corrosion

TABLE 7

Treatment	*Solution Composition*	*Operating Conditions*	*Remarks*
Caustic-anodize (Dow #12)	Sodium hydroxide — 32 oz./gal. Ethylene or diethylene glycol — 0.55 pt./gal., Sodium oxalate — 0.33 oz./gal.	10-20 amp./ft.^{2}, 6-24 volts a.c., or 6 volts d.c. 15-25 minutes 165° to 175°F.	Suspend in anodizing sol'n for 3-5 min. to remove foreign material on surface, prior to anodizing. After anodizing, allow 2 min. in bath for coating stabilization. Racks: AZ80A, AZ91A or AZ92A alloys. Rubber covered steel. Good contact essential.
A.C.-Anodic (Dow #14)	Phenol — 1 oz./gal., Sodium hydroxide — 0.33 oz./gal., Sodium metaborate — 32.0 oz./gal., Sodium metasilicate — 9.0 oz./gal.	Mg. alloys cont'g Al at 130 volts; alloy M at 100 volts, 10-15 amp./ft.^{2} Time — 5-20 minutes Temp. — 70-85°F.	Rack to prevent air or gas pockets during treatment. Agitation, either by air or water cooling coil plus mechanical agitation.
A.C./D.C.-Anodic (Dow #17)	Ammonium acid fluoride, 32 oz./gal. (A.C.) 40 oz./gal. (D.C.) Sodium dichromate — 13.3 oz./gal., 85% Phosphoric acid — 11.5 fl. oz./gal.	5 to 50 amp./ft.^{2}, a.c. or d.c. 160°-180°F.; Voltage, a.c. or d.c. up to 110. 300 to 500 ampere minutes/ft.^{2}.	Dimension increase of 0.0008-0.001" per surface. For commercial applications, 70 volt coating requiring 70-100 ampere minutes per ft.^{2} will produce satisfactory foundation.
Manodyz	Sodium hydroxide — 40 oz./gal., Sodium silicate — 4 oz./gal., Phenol — 0.48 oz./gal.	20-30 amp./ft.^{2}, 4-6 volts a.c. 10-20 amp./ft.^{2}, 4-6 volts d.c. 185°F. for sheet, 170°F. for castings. 10-25 minutes	Typical cycle will include solvent or vapor degreasing, alkaline cleaning, prepickle in chromic acid-calcium nitrate, or chromic acid-sodium sulfate solution, anodize, neutralize, and paint. Magnesium alloys used as contacts and racks with positive electrical contact. All clamping devices above solution level.
Cr-22	Chromic acid — 22 g./l. Hydrofluoric acid, 85% — 25 ml./l. Phosphoric acid, 85% — 50 ml./l. Ammonium hydroxide — 160-180 ml./l.	15 amp./ft.^{2}, 320 volts, 12 min. a.c. — 77-200°F.	Ammonium salts may be used to prepare bath provided they contain no alkali metal ions, which cause nodules on the deposit. Degreasing and activation in 15-20% hydrofluoric acid should precede anodizing.

resistance and paint adhesion; however, the dichromate treatment offered the maximum protection.

Two of the more recent developments of immersion bath compositions have been revealed by Whitbey[31] and DeLong.[32] The Whitbey patented bath is a modified chrome pickle solution to which 0.01 to 0.50% of a surfactant is added. DeLong patented an aqueous bath in which inorganic, water soluble compounds are added. The radicals mentioned included ammonium, fluoride, phosphate, sodium, and hexavalent chromium.

Electrochemical Treatments — Anodic coatings have as their outstanding characteristic a relatively high hardness and abrasion resistance. However, as these properties increase, there is a corresponding loss of flexibility and impact resistance. The d.c. process, with coating thickness up to 0.0008", is preferred for heavier gauge wrought products and for the treatment of castings. The a.c. process may be used for many of the recently developed magnesium alloys that contain cerium and zirconium.

A neutralizing treatment in hot, dilute chromic acid solution (0.5 lb./100 gal., 180-190°F., 2-5 minutes) is used to remove traces of alkalinity. The resulting chromic acid within the surface pores adds to the surface effectiveness as a paint base. When the part will be dyed, this neutralizing operation may be omitted. Where an organic sealing operation is required, particularly where the coating is transparent, traces of chromic acid may be removed by spray washing.

The HAE process[20,21] is capable of producing three types of coatings from the same bath, each by only a slight variation of the operating conditions, (a) the hard type coating that is covered by MIL-C-13335 ordnance specification, (b) the low voltage, smooth, olive drab coating, and (c) the softer type, smooth, tan colored coating.[19]

The *caustic anodize* employs an alkaline bath in which either a direct or alternating low voltage current produces the coating. It exhibits good dielectric strength and good protective qualities, particularly when given a neutralizing dip prior to subsequent waxing or painting. In processing die castings, a prepickle in strong phosphoric acid solution is recommended.[7] These coatings may be dyed by immersion in a suitable dye bath and, if they are to be painted, the anodizing treatment should be followed by a 15 minute dip[17] in a sodium fluosilicate-dichromate sealing solution.

The *a.c. anodic treatment* utilizes a high voltage, alkaline bath which produces a high abrasion resistant surface, and has the ability to cover flow marks on die cast surfaces. Subsequent operations may include either waxing, which will tend to seal the surface, or a combination of neutralizing in a dichromate-acid fluoride bath and painting. Since the voltage employed will vary with the alloy type, good practice would dictate the processing of similar alloys.

The *a.c. or d.c. anodic* treatment utilizes a high voltage, acid bath. The coating is abrasion resistant, good temperature stability even beyond the melting point of magnesium, and excellent paint adhesion qualities. Although a maximum voltage of 110 is frequently specified to obtain maximum abrasion resistance, a voltage of 70 is employed where the coating will serve as a paint base, this producing a coating that has both corrosion resistance, paint adhesion and better coating flexibility.

The *Manodyz* treatment[18] employs an alkaline bath in which either a direct or alternating low voltage current produces the coating. It is considered[19] that the film produced has marked superiority over the conventional dichromate finishes in both wear, abrasion and corrosion resistance. The a.c. process, which produces a film thickness of about 0.0004," is preferred for light gauge wrought metal not allowed to come in contact with organic materials. The bath is reputed to have the ability to remove sand and other foreign surface contamination,[21] have excellent throwing power,[20,21] and long life with suitable replenishment of the solution.

In describing the patent for the HAE coating, Evangelides[25] gave a typical composition of potassium manganate, 20 g./l.; potassium fluoride, 35 g./l.; trisodium phosphate, 35 g./l.; potassium hydroxide, 100 g./l.; and, aluminum hydroxide, 30 g./l. The operating conditions comprised a current density of at least 5 amp./ft.^{2}, a temperature range of 10-65°C. and either a.c. or d.c. current, a.c. being preferred with the optimum frequency from 13 to 50 cycles per second.

McNeill and Wick[22] reported modifications of the HAE process in which the manganate anion was replaced with stannate, vanadate, chromate, and tungstate. The base solution, which contained 150 g./l. potassium hydroxide, 30 g./l. aluminum hydroxide, 35 g./l. potassium fluoride, and 35 g./l. sodium phosphate, besides the manganate substitution, operated at 75°F., a current density of 15 amp/ft.^{2} and a voltage between 80 and 90. As recommended in the standard HAE cycle, the corrosion resistance of their coatings was improved by the use of a post-treatment, which consisted of immersion in an aqueous solution of 10% ammonium bifluoride and 2% sodium dichromate, followed by exposure in a humid atmosphere for 4 hours at 175-180°F. A 90 min. cycle in the anodizing bath produced coatings of various colors on magnesium alloy AZ31B; the coating hardness was sufficient to abrade steel that had a hardness of Rockwell C63.

The use of the above anions is mentioned in a recent patent[26] by Evangelides, such as 1 to 60 g./l. of a compound consisting of sodium and potassium chromates, selenates, stannates, tungstates, vanadates, molybdates, and borates, using water as the solvent. To this, 1 to 300 g./l. sodium and potassium fluoride, 10 to 300 g./l. sodium and potassium phosphates, 20 to 130 g./l. sodium and potassium hydroxides, and 1 to 125 g./l. aluminum hydroxide, potassium aluminate and sodium aluminate are added.

The *Cr-22* process, which utilizes the excellent passivating effect of the chromate ion, is similar to the HAE coating in that it provides a hard, corrosion resistant coating that is approximately 0.001 inch thick. Operational procedures include degreasing, activation with 15 to 20 per cent hydrofluoric acid and, finally, application of the anodic coating. Since the coating is quite hard, it may offer the same disadvantage that has been given for the HAE film; how-

ever, there is no evidence that this may be the case.

Ogden, Salmon and Kronenberg[23] evaluated the HAE film with that obtained by both the alkaline chromate and the acid chromate process, the magnesium alloy, AZ31B, being used as the base material. They concluded that the low voltage alkaline chromate process produced a coating that was comparable to that obtained by both the acid chromate and the HAE process. Salt spray tests indicated that the protective value of this coating, without the benefit of the fluoride sealing treatment, is about the same as that obtained from the HAE coating which had been given a sealing treatment. The HAE coating was superior in both color uniformity and coating distribution over the test panel.

Schaper,[13] who was particularly interested in the wear resistance of the conversion coatings for magnesium, reported modified tests on both immersion and anodic films on an unspecified magnesium alloy. His comparison also included a number of conversion coatings on aluminum. These tests, the results of which are tabulated, were performed by an automotive manufacturer with a specific application in mind. Thus, it does not comprise a comprehensive evaluation; however, it does give an idea as to the variation that may be obtained under the conditions of the tests employed. To further realize an increased wear resistance, Schaper has indicated that oil, grease or wax will usually prolong the life of the coating. Further improvement has been obtained by impregnating the coatings with colloidal graphite.

Paint Systems

Magnesium alloys can be compared to iron in that both materials are inert to alkali. This gives rise to a dilemma in that alkali formation will give a self healing effect to the magnesium surface and thus prevent corrosion, but, since this alkali may also destroy paint adhesion, it can also be a potent factor in causing corrosion. The question of surface alkalinity, therefore, should be considered, particularly in the formulation of a paint finishing system.

TABLE 8

Modified Abrasion Test* on Coated Magnesium and Aluminum Die Castings[13]

Material & Coating	*Revolutions to Wear through Coating*
Magnesium, Dichromate Treatment	800
Magnesium, Galvanic Anodizing Treatment	1,000
Magnesium, Caustic Anodize Treatment	3,000
Magnesium, Manodized, A.C. Current	2,600
Magnesium, Manodized, D.C. Current	3,500
Experimental Magnesium Anodize	22,000**
Aluminum, Anodize (Sulfuric Acid, Heavy Coating)	22,000**
Aluminum, Anodize (Chromic Acid)	2,000
Aluminum, Anodize (Sulfuric Acid, Light Coating)	3,000

*Highly polished 1020 steel disk in place of usual abrasive wheel. Test run with both surfaces dry. 72 rpm.

**Removed, no significant wear.

TABLE 9

Abrasion Test of Coated Magnesium and Aluminum Against Rotating Cast Iron

Material & Coating	*% Casting Worn**	*Average Frictional Force @ 200 psi ld.*
Magnesium, Caustic Anodize	80	21.8
Magnesium, Manodyze, A.C. Current	75	22.8
Magnesium, Manodyze, D.C. Current	45	23.7
Experimental Anodized Magnesium	3	23.0
Anodized Aluminum (Sulfuric Acid, Heavy Coating)	3	19.5

*Same number of revolutions for each specimen; all specimens lubricated with 10W oil.

A surface treatment employed as a foundation for a paint system should be (a) slightly acidic to neutral, and (b) alkali resistant. The chromate coatings, which have been discussed, provide an acid surface that promotes paint adhesion; however, they are usually lacking in alkali resistance. The treatments that fall in this category include Dow No. 1, 7, 8, 9, 10, 15, 16, and 18. The harder, more abrasion resistant coatings, as exemplified by Dow No. 12 and 14, and both the HAE and Manodyze process, are alkali-resistant, but do not provide the preferred acid type surface. According to Stevens[27] the surface treatment that imparts both an acid type surface, as well as alkali resistance, is that obtained with Dow No. 17.

To increase the alkali resistance of the chromate type coatings, a wash primer is frequently suggested (MIL-C-15328A or MIL-C-8514). A recommended wash primer is one that uses polyvinyl-butyral resin as the vehicle. Barbian,[28] Hempel[29] and Hardouin[14] have commented upon the dangers of blistering, due to an interaction of the base material and the wash primer to form hydrogen. This has been traced to an excessive phosphoric acid content, Barbian suggesting that this difficulty is minimized by limiting the phosphoric acid content to a 1.0 per cent maximum for spray gun applications. Hempel, et. al. have also suggested modifications by aging and by using a chromium phosphate as a substitute, whereas, Hardouin suggested the use of acetic acid as a substitute for phosphoric acid. Reference[14] was also made on the use of epichloro-hydrine-diphenyl resins, which produce a hard and adherent coating.

To obtain an acid surface with the alkaline anodic treatments, an acid post-treatment, such as the dichromate or the acid fluoride dip, is used prior to priming. This operation will neutralize any residual alkalinity that may be present. Rinsing after neutralizing is not recommended unless the coating will be given an organic sealing operation followed by a clear lacquer finish.

To maintain a surface film integrity on a magnesium surface, the choice of primer would depend upon its alkali resistance, and its paint bonding char-

acteristics. The selection of the primer is indeed critical, since a good deal of the difficulties of magnesium paint systems have been traced to the interface of the material to be painted and the prime coating.

Thus, Stevens[27] has stated that paints with either the vinyl or ether linkages, as the vinyls and epoxy resins, are recommended over those of the ester group (alkyds, nitrocellulose). Since abrasion resistance is also important, it is fortunate that both the vinyls and the epoxies rank with the best of paints in this respect. Barbien mentions the polyvinyl butyral primer which has excellent alkali resistance and also has the property of good adhesion even on bare or poorly treated surfaces. Both glycerophthalic type of air dry primer, and the polyvinyl-acetate with or without phosphoric acid, have been mentioned by Hardouin.

The effect of pigment in inhibiting corrosion must also be considered in the selection of a primer. Although zinc chromate is currently the most popular, strontium chromate or basic zinc chromate provide sufficient inhibiting action plus longer life, due to their relative insolubility. The use of titanium oxide has been mentioned[11] as an acceptable pigment, while, Schaper has stated that the fluorides of magnesium, barium, strontium, and lithium, as well as the chromates of zinc, magnesium, and strontium have been evaluated.

In some instances, the primer is followed by a paint coat that is pigmented with aluminum powder. The flake-like particles arrange themselves to form a protective barrier for the primer, with the result that further inhibiting action is obtained.

The finish coat of the required color must be compatible with the primer, since superposition of paint coatings with vehicles of widely different character may give some difficulty in cracking of the coating which would reduce the effectiveness of the paint system selected. The number of finishing coats, as well as the primers, will depend on the anticipated service, the very general painting procedure given in Table 10 should be used only as a guide. There are many applications where deviations from the above suggested practice will be necessary.

One typical cycle, as given by Hardouin, consisted of (a) a primer coat pigmented with zinc chromate and baked for 15 minutes at 350°F.; (b) a second paint coating pigmented with aluminum and baked for 15 minutes at 350°F.; and, (c) a final finish coat, with black pigment, that is baked for 30 minutes at 390°F.

Under severe conditions of service, such as marine exposure, baked coatings are preferred for both the primer and finish. Not only is a baked paint system superior as to adhesion, and excellent in both wear and abrasion resistance, it also has maximum absorptive resistance and rapidity in obtaining the desired finish. In the selection of a baked system, the effect of the baking temperature on the mechanical properties of the alloy must be considered. All of the alloys, with the exception of AZ31, may be heated safely to about 350°F. without detrimental results. Alloy type AZ31 may be heated to about 300°F. Although a baked system should be applied over an approved primer, satisfactory results may be obtained, particularly where the service conditions are not too severe, by applying a baked finish directly over a chemically treated surface. Novelty finishes, such as wrinkle, mother of pearl, and hammered metal effects, may also be applied to magnesium surfaces in much the same manner as that used on other metals.

A clear lacquer, usually of the vinyl or modified vinyl type, may be used on chemically colored or buffed surfaces to protect the product from wear and corrosion. Where normal outdoor service is anticipated, the air-drying vinyl lacquer or a preferred baking type enamel may be used; the baking opera-

TABLE 10

General Painting Procedures for Magnesium*

Service Condition	*Suggested Chemical Treatment*	*Paint System* *Primer***	*Finish****
Indoor	Dow No. 1,	One coat	One or more coats compatible with the primer used. Special effect or standard finish coats may be used.
Outdoor			
(a) Normal inland	Dow No. 1, 7, 9 or 17	One coat	Two or more coats compatible with the primer used.
(b) High humidity or fresh water immersion	Dow No. 1, 7, 9 or 17	One coat (titanium dioxide pigment)	Two or more coats of baked alkyd enamel, air drying vinyl lacquer, or equivalent.
Marine and other severe exposures	Dow No. 7, 9 or 17	One or two coats, zinc chromate pigmented.	Two or more coats, depending on number of primer coats used. Minimum of 4 coats total primer and finish preferred. Primer and finish preferably baked.

*This table is very general; many applications will require deviations depending upon service requirements.
**One coat primer is assumed to be 0.00035" thick.
***One coat finish paint is assumed to be 0.0005 to 0.001" thick.

tion being performed either by oven or infra-red heating methods.

With the increasing use of magnesium in high speed aircraft and missiles, high temperature resistant paints have been developed. Thus, paints containing silicones have good temperature resistance to about 600°F., whereas, the paints formulated with modified silicones and various combinations of phenolics and epoxies have temperature stability[8] between 400 and 500°F.

Outstanding examples of magnesium surface protection with a combination of Dow No. 17 foundation treatment followed with a vinyl paint system have been given by Stevens.[27]

In conclusion, a trouble-free paint system begins with the foundation treatment. Where maximum protection is required on an air dry paint system, the anodic treatments, HAE and Dow No. 17, are recommended.[17] This may be followed by an alkali neutralization treatment, a wash primer, and four coats of a zinc chromate vinyl resin primer. The top coat may be an alkyd or alkyd-vinyl enamel. As mentioned previously, the main disadvantage of the anodic surface treatments is their hard and brittle nature which may result in spalling. Of the two, Kiernan, as indicated by Burns & Bradley,[17] has preferred Dow No. 17, since it may be applied as a thinner coating than that realized with HAE and, as such, will have more flexibility and an ability to withstand more physical abuse.

Zylstra[21] has indicated that the epoxy resin formulations have excellent properties of flexibility and both impact and chemical resistance. This formulation shows considerable promise as a coating over an HAE foundation treatment, in that it tends to reinforce the HAE coating, presumably by its ability to withstand shock, and thus minimize the transmitted effect to the anodic coating.

Primers that frequently are suitable for other materials, such as steel and aluminum, are not usually suitable for magnesium. However, primers that are used for magnesium may frequently be used successfully on other materials. The selection of a primer and the adhesion and effectiveness of the finish coat should be determined by actual test, the preference being one that simulates service conditions. This procedure is usually mandatory where the conditions of service are unusually severe, or, where the pre-determined standard is high.

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THE ELECTROCHEMICAL SOCIETY

(*Continued from page* 62)

The Preparation and Magnetic Characteristics of Chemically Deposited Cobalt

By R. D. Fisher and W. H. Chilton (Physical Research Dept., National Cash Register Co., Dayton 9, Ohio)

Chemically reduced cobalt films on Mylar have been prepared and their magnetic properties evaluated with respect to squareness, coercive force, remanent and saturation magnetization. The influence of deposition parameters and thickness on the microstructure (grain size and crystal orientation) of the cobalt films was investigated in conjunction with measurement of their magnetic properties. The coercive force may be varied from 200 to 600 oe depending on experimental conditions. The magnitude of the coercive force for a specific thickness is dependent on the grain development and grain size of the film. The squareness (Br/Bm) is dependent on the thickness and crystal orientation of the film. The average saturation flux density is 10,000 gauss.

Electroless Ni-Co Films with Uniaxial Anisotropy

By J. Bagrowski and M. Lauriente (Air Arm Div., Westinghouse Electric Corp., Baltimore 3, Md.)

This study covers an extension of the work by Heritage and Walker on Ni-Co films produced by chemical reduction with uniaxial anistropy. Of significance was the anomalously low coercive force disclosed for the Ni-Co films. The extension of this work involves an attempt to understand the basic mechanism for the anistropy.

The Effect of Pressure on the Electroless Deposition Process

By J. S. Sallo, J. I. Swenson, and J. M. Carr (Honeywell Research Center, Hopkins, Minn.)

Hydrostatic pressure is shown to alter the rate of electroless nickel deposition. Two classes of acid baths exist, depending on whether the rate is increased or decreased. This difference explains conflicting literature reports. One of these systems is shown to be diffusion controlled. In the other case, the results indicate that the rate is dependent on the active catalytic area which is exposed to the system and free of hydrogen gas.

Comments on the Federal Hazardous Substances Labeling Act

By Dr. D. C. Sayles, *Huntsville, Alabama*

THE enactment of the Federal Hazardous Substances Labeling Act has established a requirement that many of the commonly-used household items, which are capable of producing illness or substantial injury, must be appropriately labeled with adequate statements warning against the hazardous characteristics of these items. The label must also provide the necessary information for first-aid treatment for personnel suffering any toxicological effects as a result of exposure to these household articles.

Included within the broad definition of hazardous substances are items which are "toxic," "corrosive," "flammable," "irritants," "strong sensitizers" or materials which are capable of generating "pressure through decomposition, heat and other means." These terms are defined within the enactment. Foods, drugs, cosmetics, economic poisons and stored fuels intended for use in heating, cooling or cooking in a home are not included. Also eliminated from the labeling provisions of the Act are products for industrial use or for use by professionals when such products are not sold to the general public.

The primary objective of this statute is to provide information relative to the dangers involved in the correct usage and/or misuse of these hazardous substances by focussing attention on the warnings on the label.

The sanctions which may be imposed for violation of the federal Hazardous Substances Labeling Act range from seizure of the incorrectly labeled items to criminal prosecution of the parties responsible for the violation. Compliance with the dictates of this statute was originally intended to be effective by February 1, 1961, but this time limit has been extended to February 1, 1962 for certain classes of substances.

Many industrial groups registered strong objections to segments of the originally proposed regulations on the basis that they went beyond the intent of the law. Cooperation between the responsible groups is necessary to ensure that this enactment meets with the approval of those parties involved.

The Manufacturing Chemists Association, the Chemical Specialties Manufacturing Association as well as other groups took exception to the booklet issued last Spring by the Food and Drug Administration explaining this Act and its regulations.

The major exception to the proposed regulations originally published under this law was that they would have resulted in extensive "overlabeling" of household products. Some items would have required precautionary labels which in the opinion of many groups, really should not need them, and the phrasing of the label's precautionary comments might be so alarming as to inaccurately reflect the degree of hazard involved. This might result in the development of various degrees of product sales resistance, due to labels, to such an extent that the consumer might become so inured to the cry of "wolf," that the hazards associated with truly hazardous materials would be overlooked.

A compromise approach was worked out between members of industry and the F.D.A., based on a realistic analysis of the hazards involved, and their description, in reasonable terms. The resulting regulations are based on the anticipated hazards resulting from the use, handling and storage of these household items, without detracting from the clear identification of the truly hazardous items.

By way of illustration, the final regulations require that carbon tetrachloride and methyl alcohol be classified as poisons and further require that the front label contain the words "DANGER-POISON" in letters of eighteen point type plus a statement of the hazard and instructions to read carefully the cautionary statement to appear elsewhere on the package. The skull and crossbones symbol must also appear on the front label.

Labeling regulations of individual states vary quite markedly, and compliance with these regulations may require, in some instances, a drastic revision from presently accepted practices and state's regulations.

Test procedures have also been established by the F.D.A. to determine toxicity, flammability, corrosivity, etc. These are outlined in the August 12, 1961 issue of the Federal Register.

The final regulations provide for the use of temporary stick-on labels which may be used in the event that lithographic work for cans or pressurized containers is not ready prior to Feb. 1, 1962.

Copies of the Federal Hazardous Substances Labeling Act and the Regulations which have been promulgated under its authority may be obtained by writing to the Food and Drug Administration, Department of Health, Education and Welfare, Washington, D. C.

FINISHING POINTERS

PRACTICAL METHOD FOR EVALUATING CATHODE EFFICIENCY

By Dr. Anton F. Mohrnheim

University of Rhode Island, Kingston, R. I.

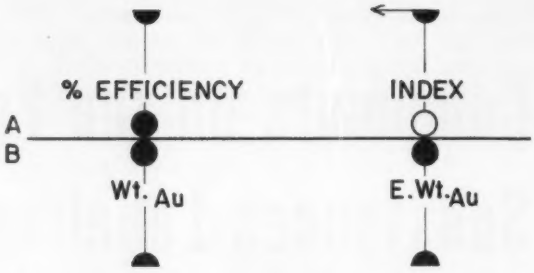


Fig. 2 showing the slide rule setting ("proportion principle") for the evaluation of the per cent cathode efficiency. The horizontal line represents the A and B scales of the slide rule, the vertical lines the positions of the hairline.

CURRENT efficiency in electrodeposition can easily be determined by connecting in series an acid copper solution (e.g. 150g $CuSO_4 \cdot 5H_2O$ and 50g H_2SO_4 per liter[1]) in a cell (coulometer) with the plating bath, and by using the weight of copper deposited as a measure of the quantity of electricity (coulombs or ampere-hours) that passed. The weight increase of the cathode of the plating bath studied divided by the equivalent weight of this deposit for the determined quantity of electricity at an assumed efficiency of 100 per cent (in accordance with Faraday's law) times 100 is then equal to the actual cathode efficiency. Experience has shown that, in practice, often much time is lost for the necessary calculations involved. By arranging the variables for the application of the "proportion principle," the result can be read conveniently and quickly on the slide rule without the intermediate determination of the quantity of electricity that passed.

Practical Slide Rule Method

The following example describes the practical slide rule settings for the evaluation of the cathode efficiency of a trivalent gold (auric) electroplating bath.

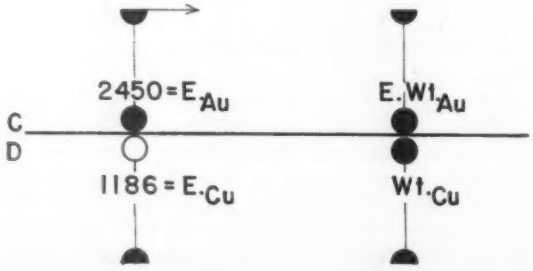


Fig. 1 showing slide rule setting ("proportion principle") for the evaluation of the equivalent weight (E.Wt.) of the deposit (Au) at 100% cathode efficiency. The horizontal line represents the C and D scales of the slide rule, the vertical lines the positions of the hairline.

1.) To find $E.Wt._{Au}$ (equivalent weight of gold deposit at 100 per cent assumed cathode efficiency), using the C and D scales of the slide rule (Fig. 1),

a. push hairline to 1186 (electrochem. equiv. of Cu) on D,

b. set 2450 (electrochem. equiv. of Au^{+++}) on C to hairline,

c. push hairline to $Wt._{Cu}$ (weight increase of Cu cathode) on D,

d. read at hairline on C, $E.Wt._{Au}$.

The electrochemical equivalent weights (2.450g Au/amp.hr. and 1,186g Cu/amp.hr.) shown in Fig. 1 are chosen as example for trivalent gold (acidic and cyanoaurate[2] plating baths) and the copper coulometer, respectively. If other baths and solutions are used, the values of the electrochemical equivalent weights of the respective metals and valencies are taken from a handbook[3] and usd correspondingly.

2.) To find the per cent cathode efficiency, using the A and B scale of the slide rule (Fig. 2),

a. push hairline to middle index of A,

b. set $E.Wt._{Au}$ (result of setting above) to hairline,

c. Push hairline to $Wt._{Au}$ (weight of gold deposit) on B,

d. read at hairline on A the per cent cathode efficiency.

By using the slide rule method above, the evaluation of the quantity of electricity that is used as an intermediate step for the calculation of the cathode efficiency is not necessary. A direct approach to find the solution to the problem is afforded, saving time, and avoiding an attendant source of possible error.

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Science for Electroplaters

69. Organic Brighteners

By L. Serota

Classes of Brighteners

ORGANIC bright nickel plating solutions contain a combination of brighteners that is divided into two fairly distinct classes, generally known as primary (or brighteners of the first class) and secondary (or brighteners of the second class). When both classes of brighteners are used together a surface with high reflectivity is produced.

The function of the brighteners of the first class is associated by E. B. Saubestre with the formation of a bright plate over a bright substrate. This class of brightener also permits the use of a wider concentration range of brighteners of the second class. This latter (wider concentration range) advantage is attributed to a greater tolerance to metal impurities in solution and a reduction in brittleness and stress in the deposit. Brighteners of the second class used alone would cause excess brittleness and stress in the deposit.

T. E. Such attributes the leveling action, or the property of hiding the polishing lines in the basis metal, mainly to the primary brightener. The principal function of the secondary brightener, it is indicated by Such, is its action as a carrier for the primary brightener, thereby permitting the use in plating solutions of larger quantities of the latter without causing excessive stress in the deposit. The term *ductilizer*, G. Dubpernell mentions, is also used for secondary brighteners.

Another advantage cited in the use of combined brighteners is the increased current density range possible. Ductility, however, Such contends, is not increased by the addition of secondary brighteners, even though antistress agents incorporated in secondary brighteners reduce the internal stress in the nickel. Data, in Table 1, compiled by Such, are listed to illustrate this effect.

TABLE I.
The Effect of Adding Proprietary Organic Brighteners to a Watt's Nickel Solution

Solution	Stress in Deposit (P.S.I.)	Ducility of Deposit*	Appearance of Deposit
A. Watt's Nickel	42,000 (Tensile)	23	Dull
B. Secondary Brightener Added to A.	3,300 (Tensile)	12	Semi-bright
C. Primary Brightener Added to B.	25,500 (Tensile)	6	Fully Bright

*All the values for ductility are given in arbitrary units and should be divided by 3 to give the percentage elongation which is approximately equivalent.

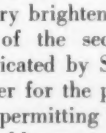
Primary Brighteners

Brighteners of the first class are identified by the presence of one or more characteristic $=C-SO_2^-$ groups in the molecule. Thus, the use of aromatic polysulfonates (as 1,5-naphthalene disulfonic acid) in a Watts-type bath, introduced by M. Schloetter about 1933, is generally associated, G. Dubpernell indicates, with the development of the modern type of bright nickel. A list, compiled by Saubestre, of the type of compounds containing the double bonded carbon =C—, as well as different linkages with the $-SO_2^-$ group used for this class of brighteners, is shown in Table 2.

The double bonded carbon in the sulfonic acids, as noted by W. L. Pinner and associates, is provided by the aryl ring (benzene, naphthalene, etc.). R. A. Hoffman also lists the use of substituted ethylene (and aldehyde) sulfonic acids, such as 2-phenyl ethylene sulfonic acid, as suitable brighteners of the first class, especially for high chloride baths. The double carbon bond in the alpha position (also in the beta position) to the sulfonic acid group is provided by the alkylenic chain or aldehyde group.

The use of aryl sulfonamides as brighteners in a nickel solution, H. Brown found, will produce a decided increase in the rate of brightening and

TABLE II.
Brighteners of the First Class ($=C-SO_2-$)

Source of (=C—)	Name	Remarks
1. Aryl ring	Benzene, naphthalene, etc.	Oldest type and widely used.
2. Substituted aryl ring	Toluene, xylene, naphthylamine, toluidine, benzyl naphthalene, etc.	as above.
3. Alkylene chain (substituted or not)	Vinyl, allyl, etc.	Especially for high chloride baths
Linkage with ($-SO_2-$)		
4. -OH	Sulfonic acid	Oldest type
5. 	Sulfonates	As above
6. $-NH_2$	Sulfonamides	Not sensitive to brighteners of 2nd class or to reducible impurities
7. 	Sulfonimides	as above
8. -H	Sulfinic acid	Represses orange peel, and dark plates
9. -R (organic radical)	Sulfones	Good brightness, tolerance to Zn, organic substances

luster with the addition of small amounts of cadmium and zinc. The method previously employed, of using cadmium or zinc as brighteners in a nickel bath without the organic addition agent, Brown notes, was too sensitive to variation. Dark streaks or skipping of plate in the recesses or low current density areas resulted with the presence of the slightest excess of such ions.

The sulfonamides or sulfonimides contain the group $—SO_2·N—$ attached to the carbon linked by the alternate double bond of the nucleus of the aromatic series. The strength of the bond between the carbon and sulfur, which Brown considers important, is modified by other active groups. An example cited is the greater brightness obtained over a wide current density range with alpha naphthalene sulfonamide than that obtained with an equal concentration of beta naphthalene sulfonic acid.

The introduction of compounds containing the double bonded carbon may also be supplied, Brown notes in one of the patents, by the addition of alpha or beta unsaturated aliphatic sulfonamides or sulfonimides, such as vinyl (ethylene) sulfonamide, $CH_2 = CH_2 So_2NH_2$, and allyl sulfonamide $CH_2= CH—CH_2SO_2NH_2$. This type of brightener can tolerate larger concentrations of zinc, cadmium or copper in a bath without showing brittle or poorly adherent deposits. The alpha unsaturated compounds show greater tolerance to impurities than do beta compounds.

Aryl sulfinic acids, such as benzene and p-toluene sulfinic acids, Brown reports in his patents, are more tolerant than aryl sulfonic acids and sulfonomides to many substances in the plating process, an effect attributed to the fact that such substances are less readily reduced when compounds containing the structure =C—SO— are used.

The regulating effect of this group is attributed to the formation of an inhibitor resulting from the reduction of the positive valent sulfur to negative valent sulfur. The effectiveness of such compounds, therefore, seems to be governed by the inhibitor formed. The aryl sufinic acids, it is noted, are more readily reduced than the aryl sulfonamides and sulfonates, indicating the formation of more inhibitors.

Secondary Brighteners

Brighteners of the second class are divided into two groups. One group is represented by salts of metals belonging to the sub-groups in the periodic system, characterized by high hydrogen overvoltage in nickel plating solutions. This type is represented in Table 3.

TABLE III.

Brighteners of the Second Class

(a) Metal ions

	Group				
Period	*IIB*	*IIIB*	*IVB*	*VB*	*VIB*
3	----	----	----	----	S
4	Zn	----	----	As	Se
5	Cd	----	(Sn)	(Sb)	Te
6	Hg	Tl	Pb	Bi	----

() denotes metals not commonly used.

TABLE IV.

Brighteners of the Second Class

(b) Organic Compounds

Radical	*Type Names*	*Remarks*
C = O	Carbon monoxide	Produces cracked deposits
	Ketones	Limited use
	Aldehydes	Quite effective
	Carboxylic acids	Not effective, except formic acid or its salts
	Proteins, as gelatin	
C = C	Alkylenic carboxylic esters	Effective with 1st class brighteners
	Alkylenic aldehydes	Active, but form resins which cause skipping
	Aryl aldehydes	Nearly valueless
	Sulfonated aryl aldehydes	Very effective
	Allyl, vinyl, etc. Also, some alkaloids	Useful with 1st class brighteners
	Coumarin and derivatives	Useful leveler; mild action
C ≡ C	Acetylene and derivatives	Effective with 1st class brighteners
	Acetylenic alcohols	Good leveling action
C = N	Azine, thiazine and oxazine dyes	These compounds, when used without first class brighteners cause brittleness, streakiness and burning. When properly compounded with first class brighteners, good leveling may be achieved. In this respect, double ring compounds are superior to single ring compounds.
	Triphenylmethane dyes	
	Quinidines	
	Pyrimidines	
	Pyrazoles	
	Imidazoles	
	Pyridinium and quinolinium compounds	
C ≡ N	Ethylene cyanohydrin	
N — C = S	Thiourea	
	Cyclic thioureides	
N = N	Azo dyes	See C = N above

The addition of cadmium, as cadmium sulfate, 2-3 grams/gal., to a nickel bath, C. H. Proctor found, gave a bright nickel deposit. For a bath that was operated constantly, $\frac{1}{16}$ to $\frac{1}{8}$ oz./gal. of solution was recommended. Excess cadmium in nickel deposits produces brittleness or slight yellowish stain when the metal dries. The formula used consists of: water, 1 gal.; single nickel salt, 12 oz.; nickel chloride, 1 oz.; boric acid, 2 oz.; ammonium chloride, 2 oz.; cadmium sulfate, ½ grain to 1 grain; temp. 75°F.; current density 35 amp./ft.^{2}.

The second group of brighteners belonging to the second class includes unsaturated organic compounds. Such compounds contain the following groups: C=O; C=C; C≡C; C=N; N=N; N=O.

W. L. Pinner and associates, in discussing this type of brightener, indicate that the presence of these groups is not necessarily an indication of a good brightener. The presence of other linkages or groups in the molecule may affect the results adversely. Some typical compounds containing these radicals are represented in Table 4.

(*To be continued*)

SHOP PROBLEMS



METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gladly received and the sender's name will be kept confidential, if desired.

Titanium Alloy Solution

Question: Our search of the literature indicates that it is not possible to deposit pure titanium from aqueous solutions. The same is true of tungsten, of course, but this metal can be deposited as an alloy with iron, nickel or cobalt. Is there a similar method or bath for depositing titanium alloys?

D. M. C.

Answer: Alloys of titanium with cobalt, containing up to 10% of the former, and in thicknesses up to 0.0004", have been produced by Russian researchers. Their bath was made by adding 4-40 g./l. titanium (as freshly precipitated titanium hydroxide) and 4-40 g./l. cobalt (as sulfate) to a solution consisting of 294 g./l. hydrofluoric acid (50%), 100 g./l. boric acid, 107 g./l. ammonium bicarbonate, and 2 g./l. glue.

Silvering Watch Dials

Question: We would like to produce the dead white finish, similar to that on watch dials, on our sheet brass parts. We understand that this is not a plating process, but a secret method concerning which we cannot obtain any details. Can you refer us to a source of information, if you cannot supply us with same?

F. R.

Answer: Watch dials are finished by a process known as "graining," which consists of application of silver paste and rubbing with a stiff brush. Best results are obtained on high-copper alloys such as gilding metal. The following formula will give a dead white finish with a raised grain effect, but varying the proportions will change the mat and grain if desired:

Silver chloride	4 parts
Cream of tartar	8 parts
Sodium chloride	1 part
Water to make a thick paste.	

Silicon-Iron

Question: Do you have any information for me on a material called "Antaciron" which is supposed to be acid-resistant. I would like to know what the material is and where it could be obtained.

A. L.

Answer: This alloy is a silicon-iron, containing about 14.5% silicon and is similar to "Duriron." The name is used by Worthington Pump for their castings.

Kunze-Willey Test

Question: Our company, as you can note from our letterhead, is a galvanizing and hot tin dip specialist. Recently, we were told that a new method of testing thickness of tin coatings, called the Kunze-Willey method, was available, by which we could not only quickly check the tin but the thickness of the tin-iron alloy layer. We would like more information, if you can furnish it, or possibly you could refer us to a suitable source.

T. R. C.

Answer: The method is not for shop control purposes but is a laboratory procedure which determines free tin and tin-iron alloy by the quantity of electricity required for anodic stripping of the deposit in dilute hydrochloric acid solution. The method was reported by C. T. Kunze & A. R. Willey (J. Electrochem. Soc., **99**, 354. 1952) and copies of their paper may be obtained in photostat form from the John Crerar Library in Chicago, which is the source nearest your plant.

Nickel Bright-Dip

Question: I have some solid nickel castings to clean up. My customer does not want to go through the expense of polishing and buffing these but would like a nice, clean finish, with as much brightness as possible. Is there a way to bright dip this metal, since I think such a finish would serve the purpose adequately? I tried wire brushing but without success. Electropolishing would probably be suitable but the job will not be in sufficient quantities to warrant the expense of an installation.

G.R. J.

Answer: Formulations of the nitric-sulfuric-acetic acid type, used for chemical polishing, have been recommended for nickel also. Two typical formulas are as follows:

1. Nitric acid ..... 30% by volume
   Sulfuric acid ..... 10% by volume
   Acetic acid ..... 50% by volume
   Water ..... 10% by volume

2. Nitric acid ..... 3 volumes
   Sulfuric acid ..... 1 volume
   Phosphoric acid ..... 1 volume
   Acetic acid ..... 5 volumes

Both solutions are used at 190-200 deg. F. It should be noted that formula "2" is the same as "1," except for the substitution of phosphoric acid for the water. Bright dipping should be followed by a good water rinse and neutralization in a bicarbonate of soda dip.

Determination of Glycerine in Electropolish

Question: I would be grateful if you could supply me with an analytical procedure for the glycerine content of my electropolishing solution. My plating laboratory is used for solution analyses and does not contain much in the way of equipment. Therefore, what would be useful is a method sufficiently accurate for maintaining the solution, but not involved or excessively precise.

R. McD.

Answer: It is presumed that the solution contains only phosphoric acid or a mixture of phosphoric and sulfuric acids, in addition to the glycerine. Therefore, a good control method would be oxidation of the organic with an excess of dichromate, followed by titration of the excess oxidant.

Weigh out 10 grams of the solution in a 50 ml. polyethylene beaker and wash it into a one-liter volumetric

flask. Shake well and pipette out a 10 ml. aliquot into a 500 ml. erlenmeyer flash. Add 100 ml. water, 15 ml. sulfuric acid and exactly 20 ml. of 0.5 N potassium dichromate reagent. Boil for 2 hours and allow to cool. Add starch indicator, 3 grams of solid potassium iodide, and titrate with standard 0.5 N sodium thiosulfate solution until the blue color disappears.

The dichromate used to oxidize the glycerine will equal 20 ml. — ml. thiosulfate. Since each ml. of 0.5 N dichromate is equivalent to 0.0033 g. glycerine, Glycerine (% by weight) =

$$\frac{\text{ml. dichromate} \times 0.0033 \times 100}{0.1}$$

$$= \text{ml. dichromate} \times 3.3$$

Synthetic Perspiration

Question: We wish to test the resistance of our plated parts to perspiration and need a formula for a synthetic equivalent so that our test conditions can be standardized. It is our understanding that such a formula is standard for testing purposes and we would be interested in a source of same. Please advise as to possible suppliers at your earliest convenience.

M. M.

Answer: There are numerous formulas for a synthetic perspiration. However, a fairly simple one consists of the following, which your local pharmacist can prepare for you without any trouble:

Sodium chloride	0.63%
Urea	0.09%
Lactic acid	0.36%
Water	11.45%
Methanol	87.47%

Non-Uniform Brass Plate

Question: I am having trouble maintaining a good lemon-yellow color from my brass solution, which was made up according to the GUIDEBOOK formula. The color all over the parts is good but I tend to get a pink on the edges. I am flashing over bright nickel and, in addition to the non-uniform color, the deposit gets dull if I plate more than 30 seconds, in spite of the use of the arsenic brightener. Can you offer any suggestions as to what I am doing wrong and how to correct these conditions?

A. A.

Answer: The pink high-current density areas and the tendency to cloud after 30 seconds, despite the presence of brightener, indicate that the voltage is too high. If the voltage is maintained between 1.5 and 2, it will be possible to leave the current on for as much as 3 or 4 minutes without signs of clouding. Sometimes, under certain conditions of composition, temperature, and position in the tank, good, uniform yellow deposits can be obtained at higher voltages, but the results are not consistent or sufficiently reliable for production purposes.

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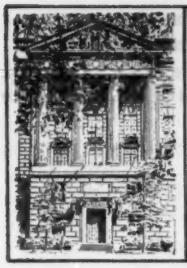
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Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD

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Belt Brushing Machine

U. S. Patent 2,989,764. *June* 27, 1961. *R. O. Peterson, assignor to The Osborn Mfg. Co.*

A machine for surface-conditioning sheets and the like.

Flat Surface Finisher

U. S. Patent 2,989,823. *June* 27, 1961. *R. W. Bernstein, assignor to Merit Products, Inc.*

A machine for surface finishing panels, sheets and the like.

Plating Apparatus

U. S. Patent 2,990,071. *June* 27, 1961. *J. V. Davis and H. J. Ward, assignors to The Udylite Corp.*

A workpiece-treating machine including a plurality of aligned workpiece-treating stations and work-carriers adapted to support workpieces.

Gas Plating

U. S. Patent 2,990,295. *June* 27, 1961. *E. R. Breining, W. M. Bolton and F. O. Deutscher, assignors to Union Carbide Corp.*

In an aluminum deposition process, wherein a substrate is heated in the presence of a heat decomposable organo-aluminum compound to deposit aluminum on the substrate, the improvement which comprises the step of intermixing, with the gaseous phase of a heat decomposable organo-aluminum compound, a quantity of an oxidizing agent in gaseous form, said quantity of oxidizing agent being present to the extent of between about 0.01 mol per cent and 0.2 mol per cent based on the mols of the organo aluminum compound present.

Metal-Boron Alloy Plating

U. S. Patent 2,990,296. *June* 27, 1961. *R. M. Hoke, assignor to Callery Chemical Co.*

A method of plating metal-boron alloys on metal objects which comprises the step of contacting the object to be plated with an aqueous plating solution containing as essential components (1) a compound selected from the group consisting of secondary and tertiary amine boranes and, (2) a compound selected from the group consisting of soluble salts of nickel and cobalt, the proportions of each component being such that the concentration of borane radical is between about 0.1 to 3 wt. per cent and the concentration of metal ion is between about 0.02 and 6 wt. per cent.

Dyeing Aluminum

U. S. Patent 2,990,304. *June* 27, 1961. *A. Cybriwsky, G. L. Hager and D. J. Schardein, assignors to Reynolds Metals Co.*

A method of coloring a microporous metal surface comprising: masking a first selected area of said surface with a composition consisting essentially of hydroabietyl alcohols while leaving a second area unmasked; and coating said unmasked second area with a coloring material which permeates the pores of said surface.

Printed Circuits

U. S. Patent 2,990,310. *June* 27, 1961. *R. Chan, assignor to Burroughs Corp.*

The method of making an electrical unit including a plurality of circuits on a laminated mounting board comprising the steps of affixing a pair of circuit terminals respectively to the opposite sides of a dielectric lamina around the opposite ends of a hole in the lamina, affixing a circuit terminal to one side only of a second lamina around a hole in the second lamina larger in diameter than the hole in the first lamina, bonding the laminae flat together with one of the terminals of the first lamina against the other side of the second lamina and with the holes substantially aligned so that an inner margin of the intermediate terminal is exposed as a land between the holes, and thereafter electroplating the terminals to form conducting bridges between the land of the intermediate terminal and the outer terminals.

Chromium Alloy Bath

U. S. Patent 2,990,343. *June* 27, 1961. *W. H. Safranek, assignor to the United States of America*

An aqueous bath consisting of a chromium salt providing from 20 to 75 g./l. of trivalent chromium ions, an alkali metal salt providing from 10 to 150 g./l. of alkali metal ions, and a salt of at least one alloying metal providing alloying metal ions of the group consisting of from .6 to 2.5 g./l. of iron ions, .1 to 1.0 g./l. of nickel ions, and .1 to 1.0 g./l. of cobalt ions.

Non-Cyanide Cadmium Bath

U. S. Patent 2,990,344. *June* 27, 1961. *P. N. Vlannes and S. W. Strauss*

In the electrodeposition of cadmium, the improvement which comprises electrodepositing cadmium from a non-cyanide aqueous bath consisting essentially of a solution in water of a cadmium salt of a concentration of from about 0.5 to 2 molar to which triethanolamine has been added in amount such that the molar ratio of triethanolamine to cadmium is from about 1:1 to 4:1 and the pH of the bath is in the range of from above 7 to about 10.

Mask for Organic Finishing

U. S. Patent 2,991,188. *July* 4, 1961. *R. E. Wing and B. G. Hofmeyer, assignors to The Dow Chemical Co.*

Masking an exposed surface area which is not to be coated by applying thereto a continuous film of a masking composition comprising a water-soluble polyoxyalkylene compound having a melting point of about 25-90°C., spraycoating the first said surface and removing both the spray-coat and the masking composition from the masked surface area by melting said film of masking composition and mechanically removing the thus loosened film and coating.

Mask for Organic Finishing

U. S. Patent 2,991,189. *July* 4, 1961. *R. B. Rickert, assignor to The Dow Chemical Co.*

A process for making a coated substrate having a water removable protective film which comprises depositing upon a substrate a continuous film of coal acids, said coal acids being the

water-soluble, mixed aromatic carboxylic acids that are the products of the oxidation of carbonaceous materials, which acids typically have an average molecular weight of about 250, an average equivalent weight of about 80 and contain an average of from about 2.5 to 5 carboxylic groups per aromatic nucleus in their molecules.

Finishing Machine

U. S. Patent 2,990,655. *July* 4, 1961. *E. J. Guinn, assignor to Lyon Inc.*

A swing-arm machine for driving a rotary buffing wheel.

Buffing Stainless Steel

U. S. Patent 2,991,205. *July* 4, 1961. *R. A. Lincoln and W. G. Renshaw, assignors to Allegheny Ludlum Steel Corp.*

A method for improving the corrosion resistance of chromium type stainless steel alloys which comprises applying to the surface of said alloys an in situ formed coating of hydrated mixed chromium oxides and then buffing down the coating until its presence is not apparent to the eye.

Porcelain Enameling Aluminum

U. S. Patent 2,991,234. *July* 4, 1961. *J. M. Andrus, assignor to Croname, Inc.*

A method of coating aluminum with vitreous enamel which comprises electrochemically producing an anodic aluminum oxide film having a thickness of from about 0.0002 to about 0.00005 inch on said aluminum, directly coating at least a portion of said film with a fusible vitreous material, and heating the coated film to at least the fusion temperature of said vitreous material.

Buffing Compound Applicator

U. S. Patent 2,991,598. *July* 11, 1961. *G. C. Kuntz, assignor to General Motors Corp.*

A device for applying a liquid buffing compound directly onto a buffing wheel.

Automatic Barrel Plater

U. S. Patent 2,991,791. *July* 11, 1961. *L. Rozenfeld, assignor to Les Procedes Rovac*

Apparatus for processing work by immersion in a series of treating tanks, which comprises a series of tanks disposed in an annular array, an upstanding post disposed centrally of the array, at least two uprights rotatably supported from said post for independent rotary movements along a circular path adjacent the inner periphery of said annular array of tanks, an arm pivoted to each of said uprights about an axis normal to the axis of said post, a container for said work rotatably supported on said arm, power means disposed on each upright, and gearing drive means on said upright, energized by said power means for rotating said container, means for imparting to each of said uprights an autonomous rotation about said post past the successive tanks of the array, and independent moving means provided on each of said uprights for pivoting said arm for immersing said work carrying means into and withdrawing it out of said tanks.

Paint Spray Gun

U. S. Patent 2,991,940. *July* 11, 1961. *W. W. Dupler and J. A. Gustairs, assignors to General Motors Corp.*

In a spray gun, a handle having a control valve, and a detachable head.

Organic Coating Machine

U. S. Patent 2,992,134. *July* 11, 1961. *R. E. Russell and N. Channin, assignors to Wallace Silversmiths, Inc.*

Method of dip coating articles.

Electrostatic Spraying

U. S. Patent 2,992,139. *July* 11, 1961. *G. E. Arhart, assignor to Desoto Chemical Coatings, Inc.*

A method of coating a normally nonconductive base article, comprising applying to the surface of said article a coating material distributed in a liquid medium containing in solution a relatively small portion of phosphoric acid, drying, and thereafter spraying said coated article in an electrostatic field with a second coating.

Ultrasonic Cleaning Method

U. S. Patent 2,992,142. *July* 11, 1961. *T. J. Kearney, assignor to Detrex Chemical Industries, Inc.*

A method of cleaning a work object comprising the steps of immersing the work object in a chlorinated hydrocarbon liquid, piezoelectrically creating a beam of ultrasonic waves having a frequency in the range of from 200 to 1000 kilocycles by electrically energizing piezoelectric means which is submerged in said chlorinated hydrocarbon liquid, said piezoelectric means being out of direct mechanical contact with said work object, focusing said beam of ultrasonic waves toward a focus point, and moving said work object through said liquid between said piezoelectric means and said focus point, thereby to strike said work object with said beam while said beam is converging toward the focus point.

Phosphating Process

U. S. Patent 2,992,146. *July* 11, 1961. *F. G. Low, assignor to E. I. duPont deNemours & Co.*

In a process for treating a metal article, the step of contacting said article with an aqueous phosphating solution at a temperature between 65° and 90°C. within a trichlorethylene vapor zone.

Chromium Plating Aluminum

U. S. Patent 2,992,171. *July* 11, 1961. *W. D. MacLean and K. C. Graham, assignors to General Development Corp.*

The method of electrodepositing a chromium plate directly on the surface of an aluminum article; which comprises immersing said aluminum article in a plating bath comprising a mixture of 15-45 oz./gal. CrO_3, H_2SO_4, the ratio of CrO_3 to H_2SO_4 being in the range of 80/1 to 200/1, water, and 0.0333-6.0 oz./gal. SiO_2 as particles of submicroscopic dimensions carried in suspension in said bath; and electrolyzing said bath to plate said article.

Stripping Lead

U. S. Patent 2,992,946. *July* 18, 1961. *B. Arden and F. E. Clark, assignors to Purex Corp.*

The method of removing leaded deposits from a metallic part carrying the same, which comprises contacting said metallic part at an elevated temperature with a solution containing from about 4 to about 40 parts by weight of alkali metal hydroxide calculated as alkali metal oxide and from about 1 to about 45 parts by weight of a lead complexing agent chosen from the group consisting of the water soluble alkali metal salts of the fatty acids of 1 to 4 carbon atoms and the hydroxy aliphatic acids, said hydroxy aliphatic acids being chosen from the group consisting of lactic acid, citric acid, tartaric acid, gluconic acid, glyceric acid, malic acid, glycollic acid and saccharic acid.

Alkaline Rust Remover

U. S. Patent 2,992,187. *July* 11, 1961. *H. Gershon, assignor to Pfister Chemical Works, Inc.*

The method of removing iron rust from rusty objects, which method comprises treating rusty objects with a solution consisting essentially of from 1% to 50% by weight of sodium hydroxide and from 0.01% to 10% by weight of a sequestering agent, the balance being essentially water, said sequestering agent consisting essentially of a mixture of from 1 to 3 parts by weight of sodium glucoheptonate with from 3 to 1 parts by weight of sorbitol.

Alkaline Deruster

U. S. Patent 2,992,997. *July* 18, 1961. *B. Arden and F. E. Clark, assignors to Purex Corp.*

A composition suitable for derusting of iron when used in water solution, said composition consisting essentially of a mixture of an alkanolamine in which each carbon chain has 2 to 3 carbon atoms, said alkanolamine being a member of the group consisting of trialkanolmonoamines and polyalkanolpolyamines, said polyalkanolpolyamines containing up to 6 alkanol groups and up to 4 amino groups, a water soluble salt of a hydroxy aliphatic acid chosen from the group consisting of lactic acid, citric acid, tartaric acid, gluconic acid, glyceric acid, malic acid, glycollic acid, and saccharic acid, and water soluble alkali such that when said composition is added to water the resulting solution has a pH in excess of 13, said mixture consisting essentially of from about 2% to 95% by weight of said alkali, about 2% to about 62% by weight of said alkanolamine and from about 2% to 50% by weight of said salt, the said ingredients totaling 100% of said mixture.

Copper Plating Molybdenum and Tungsten

U. S. Patent 2,993,271. *July* 25, 1961. *P. W. Crapuchettes, assignor to Litton Industries, Inc.*

A process of preparing a copper coated metal sheet stock from a metal having a relatively low coefficient of thermal expansion selected from the group consisting of molybdenum and tungsten, which comprises, flashing the stock with nickel in a Cl^- and F^- solution at a low pH, plating the flashed stock with nickel to a thickness of substantially .0002 inch, heating said nickel plated stock to a temperature of approximately 1350°C. for a period just sufficient to completely flow the nickel and thereafter forming a continuous conductive bond between a copper coating and the nickel surface over substantially the whole surface.

Spray Coating

U. S. Patent 2,993,468. *July* 25, 1961. *A. W. Zmuda and J. L. Howe, assignors to The DeVilbiss Co.*

Apparatus for coating an article with an atomized liquid coating comprising a rotatable porous, annular member, means for rotating said member and means forming a plurality of uniformly circumferentially spaced, stationary orifices spaced inwardly from an interior surface of said rotating member.

Degreasing Method

U. S. Patent 2,993,493. *July* 25, 1961. *G. Edhofer, assignor to Wacker-Chemie G.m.b.H.*

Apparatus for cleaning objects with volatile solvents comprising, in combination, a closed container having means for admitting the objects to be cleaned, a rotatable support in said container for the objects to be cleaned, jets in said container for spraying fluid solvent upon the objects on said support, stationary control heads containing apertures mounted on said container above and below said support, rotatable control plates cooperating with said control heads to close the apertures in the latter and containing apertures adapted in certain positions of said rotatable control plates to coincide with the apertures in said control heads, and sources of liquid and vaporous solvent connected respectively to separate apertures in said control heads.

Protective Coating for Molybdenum

U. S. Patent 2,993,264. *July* 25, 1961. *H. E. Grenoble, assignor to General Electric Co.*

A composite article including a body consisting substantially of molybdenum and a multiple layer coating substantially covering the surface of said body to provide improved resistance against high temperature oxidation of said body when it is subjected to cyclic stresses, said multiple layer coating comprising a first chromium layer deposited on said body as a continuous film covering substantially the entire surface thereof, and a plurality of nickel layers of from 0.0006 to 0.0008 inch thick alternating with a plurality of chromium layers of from 0.0002 to 0.0003 inch thick, said layers being present as continuous films covering said first chromium layer and ending in an outermost layer of chromium, adjoining nickel and chromium layers forming alloys at the interfaces therebetween which improve the protective properties of said multiple layer coating.

Cleaning Method

U. S. Patent 2,993,494. *July* 25, 1961. *S.A.G. Svensson, assignor to Aktiebolaget Separator*

In an apparatus for cleaning a machine part having a throughflow channel, said apparatus including a closed container wherein a subatmospheric pressure and at least atmospheric pressure are alternately created, and an open container for containing a cleaning liquid adapted to flow back and forth through said channel between the containers under the action of said alternating pressures, the combination of a membrane dividing said closed container into first and second chambers and movable between two extreme positions, a valve device operable to connect the first of said chambers alternately to a vacuum source and a source of at least atmospheric pressure in response to movements of the membrane to first one and then the other of said extreme positions, and coupling means for connecting the second of said chambers to the open container through said channel of the machine part, whereby said membrane movements cause said liquid to flow back and forth through said channel.

Pickling Waste Recovery

U. S. Patent 2,993,757. *July* 25, 1961. *J. O. Dasher and D. Goldstein, assignors to Crucible Steel Co. of America*

In the method of recovering nitric and hydrofluoric acid values from a waste pickle liquor solution containing nitrates and fluorides in solution, the steps of: distilling the waste pickle liquor solution at about 150°F. and three inches of mercury to drive off

a maximum of water without substantial loss of acid radical, adding sulfuric acid to the concentrated liquor from said distillation step, further distilling the mixed product at 150°F. and one inch of mercury to drive off nitric and hydrofluoric acid while forming a 25% solids slurry of sulfate salts in sulfuric acid, separating the sulfate salts from the sulfuric acid slurry, recycling the sulfuric acid recovered in the separation step through said last type mentioned distillation process, and condensing the vapors derived from the first and second distillation steps.

Hot-Dip Coating

U. S. Patent 2,993,804. *July* 25, 1961. *S. Yonezaki and M. Obu, assignors to Yawata Iron and Steel Co., Ltd.*

A method of treating the surface of a metal article hot dip coated with another metal, the surface of the coating metal having spangles thereon, comprising heating said metal article to a temperature above the melting point of said coating metal and spraying a gas flame onto the surface of the coating metal at an angle thereto and over the entire surface of the coating metal at a temperature between 600° and 1000°C. at a pressure of from 1000 to 4000 mm. of water and for a period of from 2 to 60 seconds, whereby spangles on said coating metal surface are fused and innumerable microindentations are formed thereon and an improved appearance and paint adhesion is obtained on said coating metal surface.

Electrostatic Spraying

U. S. Patent 2,993,808. *July* 25, 1961. *T. Thornberry, assignor to Ransburg Electro-Coating Corp.*

A method of electrostatically coating a surface of a sheet-like article made of nonconducting material, comprising maintaining a first electrode at a substantial polarity relative to ground and maintaining a second electrode spaced from said first electrode at a substantial opposite polarity relative to ground thereby to create an electrostatic field therebetween, providing in the region adjacent said first electrode a spray of finely divided particles charged similarly to said first electrode, passing the sheet-like article through the mid-portion of said electrostatic field with the article surface to be coated facing the spray of charged particles, and maintaining said article surface at all times during the coating thereof exposed to only that portion of said electrostatic field created by said first electrode thereby to electrostatically attract the spray particle to said surface and deposit them onto the surface as a coating.

Dry Acid Pickling Salt

U. S. Patent 2,994,664. *Aug.* 1, 1961. *B. J. Wachter, assignor to Nalco Chemical Co.*

A solid, acid cleaning composition which comprises a blend of (A) a hydroxy substituted carboxylic acid, said acid being soluble in water at 20°C., as its calcium salt, to the extent of at least 500 parts per million and having a dissociation constant (K_1) of from 2×10^{-3} to 1×10^{-5}, and (B) sulfamic acid, the weight ratio of (A) to (B) being within the range of 1:2 to 2:1, said composition containing from 2% to 30% by weight of a corrosion inhibitor.

FOREIGN LITERATURE

Chrome Plating of Aluminum by Superimposed Alternating Current on D.C. Current

A. F. Bogojawlenski. *Zurnal Prikladnoj Chimii* (Russia), **33**, No. 2, 368.

Previous investigations by the author in this field of research have been concerned with the application of an asymmetric alternating current in chromium plating brass. The present research reports that, in chrome-plating aluminum, with the superimposition of an a.c. or a d.c. current, no usable coatings were obtained. The investigations were concerned with the measurement of the directional effect in a normal chromium bath, the polarization of the aluminum cathode with superimposed alternating currents, and the influence of the alternating current on the current efficiency of the bath, the micro-hardness, and the adhesion of the chromium deposit.

Anodic and Chemical Polishing of Metals — Processing of Watch and Clock Parts

Dr. Wulhorst. *Galvanotechnik and Oberflaechenschutz* (Switzerland) **1**, No. 2, 25.

A general survey was made and the differences discussed, between mechanical and anodic electropolishing and chemical polishing baths for metals. The author studied the phenomena and reactions occurring at the metal surface during anodic electropolishing. The possibilities of the application of alternating current during electrolytic polishing were then considered. The special characteristics and advantages of chemical polishing processes for component parts used in the watch and clock-making industries, were subsequently dealt with. Standard practice used in the Swiss watch and clock industries for internal parts consisting of 58 and 63% brass, is to process in a chemical polishing bath, as follows:

A pretreatment is given in bath 1 for a period of about 1-2 minutes at room temperature, followed by an anodic electropolishing treatment in bath 2. Solid gold parts are best handled by treatment in bath 3, using an electrolytic polishing technique.

Bath 1

H_3PO_4 (1.7)	4 liters
Acetic acid	3 "
HNO_3 (1.39-1.40)	3 "

Bath 2

H_3PO_4 (1.7)	3.6 liters
Acetic acid (70%)	4.65 "
Ethylene glycol	1.75 "

Bath 3

Potassium cyanide	20 g./l.
Potassium ferrocyanide	5 "
Potassium carbonate	25 "
Albumin	0.25 "
Dioxan	50 cc./l.

Reduction Copper-Coating (Contact Coppering) of Aluminum

N. S. Zwetkow & O. S. Saretschnjuk. *Zurnal Prikladnoj Chimii* (Russia) **33**, No. 3, 636.

The tests described by the authors were carried out in alcoholic copper chloride solutions. For the production of compact coatings, firmly adherent on aluminum, the following factors play an important role:

1. The reduction of the Cu^{++} through Cu^{+} to Cu°.

2. The amount of the copper deposited is in direct linear relationship to the water content of the cupric chloride electrolytes.

3. $Cu^{++} + 2e \rightarrow Cu^{\circ}$; with higher cupric chloride contents the reaction goes only to Cu^{+}.

4. Apart from a short induction

LEA

ABRASIVE FINISHING METHODS

NICKEL and NICKEL ALLOYS

STAMPINGS • CASTINGS • FORGINGS • FORMINGS • DIE CASTINGS

Pure nickel and the high nickel alloys may be finished to any of the mechanically produced effects obtainable on white metal, ranging from a sand blast finish to the high lustrous mirror finish. A satin finish can be produced with fewer operations and very much less time than is required for a high lustre polish. No short cuts for developing a desired effect are possible. A "base" from which all surface defects have been removed must be produced and on this the finish is developed. The coarser the abrasive required to produce this "base", the more operations required to produce the desired finish. Each subsequent operation must remove the wheel marks produced by the preceding operation.

Nickel Silver, because of the quantity used in the metal industry, must be considered as one of the most important of the nickel alloys. However, because of its high copper content and tendency to tarnish, it is seldom used by itself but generally as a base metal for subsequent electrodeposits. It is much easier to machine and abrade than harder nickel alloys and responds more readily than the higher nickel alloys to cut-down buffing.

Nickel is one of the most important metals applied by electrodeposition and the finishing of nickel plate will be covered separately.

POLISHING... Recommended polishing speeds for nickel alloys are about 6500 to 7500 sfm. Recommended wheels are sewed buffs, felt, canvas and leather polishing wheels, coated with **Leabrament** or **Plasti-Brade** (liquid abrasive compositions). If loose abrasives are used for preparing polishing wheels, **Gripmaster** or **Plasti-Glue** polishing wheel cements should be used.

INTERMEDIATE FLEXIBLE POLISHING...To remove small defects, flash, etc. and produce a uniform finish, use **Grade "C"** or **Grade "N" Lea Compound** on sewed buffs at 6000 sfm. A special application of this is in the edging of nickel silver flatware immediately after trimming. For this, **Grade "C" Lea Compound** is used on an 8" diameter, 6" face packed muslin buff at 2400 rpm.

SATIN FINISHING...For the production of a satin finish, **Grade "N" Lea Compound** is recommended on a high count full-disc muslin buff at 5500 sfm. Finer and coarser grades of **Lea Compound** are available.

BRIGHT FINISHING—Bar Compositions...To prepare the surface of nickel silver for plating, it is generally given a cut-down buffing operation with a Tripoli composition such as **Grade 765 Learok** on a pocketed or ventilated buff at about 8000 sfm.
To produce a bright finish on high nickel alloy base metals, the following procedure has been used to advantage: cut-down buffing with **Grade 316 Learok** on a loose muslin buff at 7500 sfm; then color buff on the same type of wheel and at the same speed using **Grade 302-C Learok.**

BRIGHT FINISHING—Liquid Compositions...For **cutting down** operations use **Grade TH52P Liquabrade.** For **coloring operations** use **Grade UF47J Liquabrade.** For **high coloring** use **Grade UH20A Liquabrade.** Buffs and speeds for use with **Liquabrade** are the same as for Bar Compositions.

BUTLER FINISHING...Butler Finishing is carried out after bright finishing with **Grade "B-12"** and **Grade "MH" Lea Compound** at about 5000 sfm.

THE LEA MANUFACTURING CO.
16 CHERRY AVE., WATERBURY 20, CONN.

Lea-Michigan, Inc., 14459 Wildemere, Detroit 38, Mich.
Lea Mfg. Company of Canada, Ltd., 1236 Birchmount Road, Scarborough, Ontario, Canada
Lea Mfg. Co. of England, Ltd., Byron St., Buxton, Derbyshire, England
Lea-Ronal, Inc. Main Office and Laboratory: 130-19 180th St., Jamaica 34, N. Y.
Sales & Manufacturing Plant: 235 East Aurora St., Waterbury 20, Conn.

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Pieces . . . . . electrical connectors
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Place . . . . . customer's plant
Test . . . . 30 minutes in boiling concentrated nitric
Results . no sign of corrosion or attack on base metal

Comparative tests on parts plated with same thickness of gold from both conventional cyanide and acid golds showed complete attack of the base metal in less than 10 minutes.

Make this simple comparative test with your own gold plate and see the advantages the Aurall Gold offers you. It is possible to obtain complete protection with lesser thickness of plate with Aurall Gold, thereby saving in gold.

Aurall Gold will provide not only the answer to simplification of your plating operations but substantial improvements in corrosion protection, freedom from porosity, and the ability to withstand high temperatures without discoloration.

Full details will be sent promptly on request.

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- ★ Bright to lustrous, all-inclusive 24K gold plating process.
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- ★ Meets critically exacting industrial and scientific requirements where high degree of ductility, freedom from porosity and excellent solderability are required.
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- ★ Combines advantages of cyanide and acid baths in one solution that does not deteriorate with age or in prolonged operation.
- ★ Simple to operate; easy to control.

Piece shown in the headline is four times actual size.

*Patents pending

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period, the process operates at a constant linear speed.

5. A falling-off in the speed of the reduction process, which occurs later, is caused by the destruction of the oxide film formed on the aluminum at the start, and the cupric chloride electrolytes becoming sluggish.

The Formation of Wear Resistant Coatings on Anodized Oxide Coatings by the Addition of Certain Dyestuffs to the Sealing Bath

F. Modic (Jugoslavia). *Aluminium* (Duesseldorf, Germany), **36**, No. 8, 457.

Investigations were conducted on sheet test parts of 99.7 quality aluminum, with the object of ascertaining the sealing action of certain dyestuffs which are added to the sealing bath in small quantities. The working conditions under which the tests were conducted, were as follows:

Anodizing:

Electrolyte ..... 20% sulfuric acid
Current density .... 1.5 amp./dm.^{2}
Temperature ..... 20°C.
Coating thickness .. 10-12 microns

Dyeing and Sealing:

Dye bath concentration .. 1-5 g./l.
pH of dyebath 4-6
Bath temperature ..... 60-65°C.
Dyeing time ..... 15 minutes
Sealing temperature ..... 98°C.
Sealing time ..... 30 minutes
Dyestuff in sealing bath 0.05 g./l.

Dyestuffs of various groups were investigated. In this research it was definitely found possible to demonstrate that the sealing action, with all the dyestuffs considered, can be related to their molecular composition. Certain chelate-forming groupings in the dyestuff molecule are responsible for their behavior. With the processing as described above, a brilliant and wear-resistant oxide coating is always obtained after the sealing.

Corrosion Inhibitors and Knowledge of their Mode of Action

W. Funke. *Mitteilungen Forschungs Gesellschaft Blechverarbeitung* (Duesseldorf, Germany). Nos. 1, 2; 14.

Investigational work has been carried out by the above research association to compare and test the effectiveness of organic inhibitors in non-acid aqueous solutions under constant test conditions. The purpose of the investigation also was to ascertain what connection exists between the chemical constitution and the protective action of the organic colloids.

The results obtained in this research work provide indications and starting points regarding the mode of action of the compounds investigated, and permit of a division in the known classes of corrosion inhibitors.

Electrical Insulating Characteristics of Phosphate Coatings

Metal 1-Reinigung u. Vorbehandlung (Hamburg, Germany), **9**, No. 12, 214.

Phosphate coatings have several different applications and are used for the purpose of affording corrosion protection, for improving the drawing characteristics of metals, such as wire forming and steel tube and bar forming, for providing an improved film to give better lubrication characteristics with metal surfaces, for giving an improved adhesion surface for lacquer applications, and for the improvement of electrical insulation properties, for such purposes as electrical motor and transformer sheet.

Phosphate coatings to provide improved electrical insulation characteristics are formulated to give zinc phosphate coatings which are resistant to break-through voltages of 80 to 220 volts if the coating thicknesses are selected at about between 2 to 12 microns. Full details and operational data are given in the text, based on the practice of the German Metallgesellschaft (Frankfurt), who are one of the leaders in the field of phosphating techniques.

Development and Investigation of Bright Copper Plating Techniques

T. Chocianowicz-Biestkowa & K. Szmidt. *Prace Instytutu Mechaniki Precyzyjnej* (Poland), **8**, No. 30, 45.

Copper deposits were plated from an electrolyte containing copper 50, potassium cyanide 15, potassium carbonate 20, and potassium sulfocyanide 2 (g./l.). Periodic current reversal technique was used and bright copper deposits of a good appearance were obtained, without bath agitation.

From this as the starting point, investigations were then carried out to determine the degree of influencing of the brilliance and appearance of the deposit exerted by the individual bath constituents, as well as the influence, if any, of agitation. It was found that satisfactory results can be obtained with a plating speed of 1 micron/minute.

Investigations were also carried out on an alkaline type of bath, to which a brightening agent and wetting agent were added. Plating was conducted at a bath temperature of 72°C., with agitation, employing a current density of about 3 to 4 amp./dm.^{2} These copper deposits also showed a good appearance and a high brilliance, in spite of the fact that the bath was operated without periodic current reversal.

Determination of the Leveling Action of Plating Baths by Means of Radioactive Isotopes

S. E. Baecon & B. J. Riley. *Galvanotechniek* (Holland), **4**, No. 4, 86.

Earnest endeavors are being made by all firms offering plating baths, to provide for the customer a bath from which coatings can be obtained which are capable of filling-out the finer irregularities in the basis surface, i.e., to provide a leveling effect. This action can be initiated by means of special additions to the bath formulations. As the mechanism of the leveling action in the plating bath is very complicated and has not yet been researched completely in all aspects of the matter, investigations in various countries are continuously being undertaken to throw fresh light on the matter.

The authors give details of a process, by which radio-active isotopes are used. The Watts nickel bath was used as the basic bath. To this bath were added radioactive sodium allyl sulfonate and sodium allylquinaldin bromide. Details are given of the preparation technique for these special test baths. The measuring cell in which the tests were conducted is detailed.

A brass block was used as the cathode, in which a zig-zag structure had been roughed-out on one side (similar to the cuts on a file), with grooving depths of 0.8 mm., with a criss-cross angle of 90°. After precleaning, a parting coating was applied by means of potassium dichromate, the test part was again rinsed, and then nickel-plated for a test period of 100 minutes. The separated nickel deposit was then tested for radioactivity by means of a Geiger counter. Some 65 tests were made altogether, which enabled conclusions to be drawn regarding the actions of the additions mentioned above, in relation to the leveling action exerted by the bath containing these additions.



Electroless Nickel Plating Bath

Enthone, Inc., Dept. MF, 442 Elm St., New Haven 8, Conn.

Enplate Ni-410 chemical nickel plating bath is stated to deposit a uniformly thick, hard, corrosion resistant nickel plate without the use of electric current.

It will deposit electroless nickel by chemical reduction on aluminum and other metal substrates, in addition to plastics, glass, rubber, and many other non-conductors. It deposits a nickel-phosphorus alloy, which is more corrosion resistant than electroplated nickel.

The product is supplied as two purified liquid concentrates, Ni-410A and Ni-410B, which are added to water to make up the plating bath. It requires no dummying and produces excellent deposits immediately after make-up. At an operating temperature of 190°F., the plating rate will initially be 0.375 to 0.400 mil/hr. The bath can be maintained for long periods by replenishment and pH control.

Acidproof Clothing

Worklon, Inc., Dept. MF, 253 W. 28th St., N. Y. 1, N. Y.

For use in highly corrosive areas,



work clothes of 100% polypropylene fabric provide a long-sought answer for work clothing with superior resistance to strong acids and caustics. Where corrosive chemicals normally deteriorate ordinary garments, polypropylene now offers remarkable benefits in long wear, and considerable savings in replacement costs of clothing.

The new fabric is strong, yet lightweight, dries quickly, and offers better wearing comfort and shape retention, according to the manufacturer.

Additive for Bright Dips

Alchemize Corp., Dept. MF, 625 S. Kolmar Ave., Chicago 24, Ill.

Additive LS'N is a new product formulated to reduce processing difficulties inherent in aluminum bright dips. It drastically lessens fuming, drag-out, pitting and streaking. Color and brightness are substantially improved, simultaneously, it is claimed.

The product is suitable for any of the phosphoric acid-based dips. Only 1%, by volume is required, and it is completely stable at all concentrations and temperatures.

Cabinet Ovens

DeVilbiss Co., Dept. MF, Toledo 1, Ohio.

Compact, standard cabinet ovens, suitable for batch production, limited production runs or experimental work requiring temperatures from 150 to 500°F., are available in four sizes, three heating capacities and for electric or gas heat. They are factory assembled and test operated. All exterior surfaces are prime painted prior to shipment in ready-to-connect condition.

Features include 4-inch Fiberglas insulation on top, sides, back, floor and door; 20-gauge steel, leakproof construction with minimum amount of through metal, safety pressure release door latch; two sliding shelves designed for free heat flow, with additional shelf guides built into each model; horizontal heat flow from directly connected blower and motor, with capacity



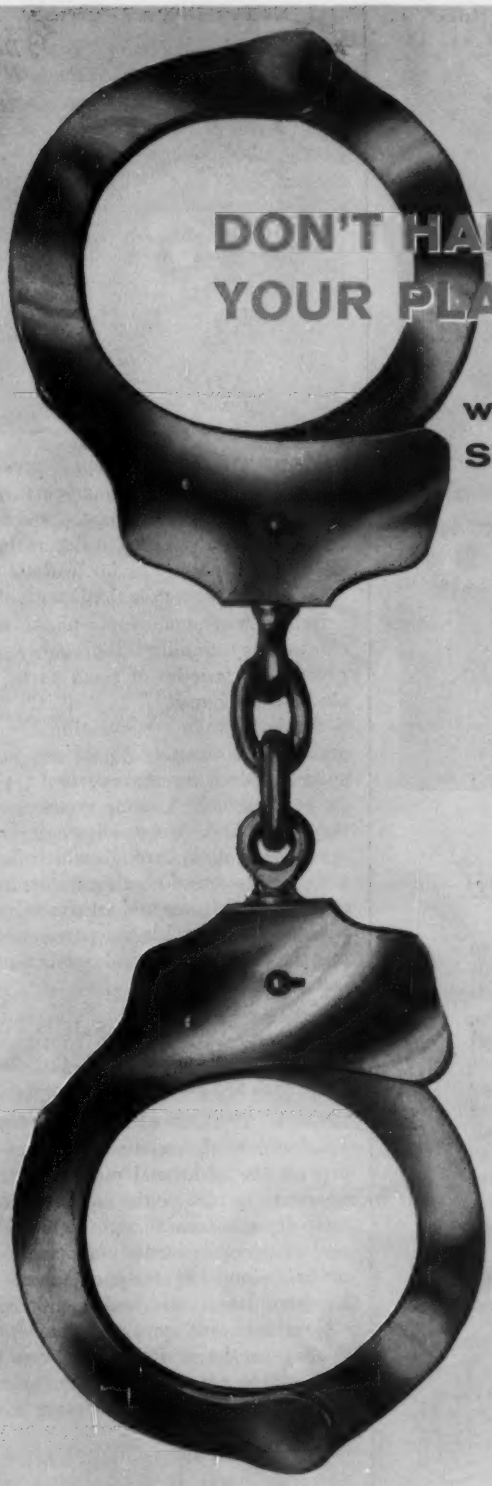
adjusted to size; gravity type exhaust with power system available, and direct-reading automatic temperature control, with recording type controller offered as an accessory.

Oven sizes range from 2′ x 2½′ x 2½′ (interior dimensions) to 3′ x 4′ by 2½′. Both atmospheric and premix type ovens are available in gas-fired models. Accessories include, in addition to the recording controller and powered exhaust system, a fresh air filter chamber, extra shelves and matching steel cabinet enclosures for the controls and heating equipment.

Zinc Barrel Brightener

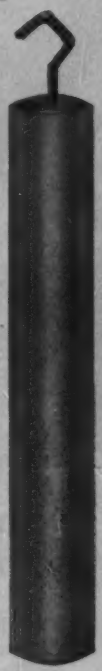
R. O. Hull and Co., Dept. MF, 1260 Marion Ct., Cleveland 16, Ohio.

"Econobrite" is a balanced combination of premium-type processes concentrated in a single low-priced, one-shot brightener for barrel zinc plating. It features broader latitude of operating conditions at minimum costs, averaging only 6 to 10 cents per barrel-hour, it is claimed. Easy to use, its greater tolerance for variables — temperature, contamination, concentration, etc. — virtually eliminates need for special attention. Greater stability for operating efficiently in higher temperatures without danger of breakdown prevents excessive usage. It is available in powder or liquid.



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Add Seaway Nickel to your list of ROLLED NICKEL ANODE Suppliers...and you add a new dimension of flexibility to your plating department.

Then Seaway delivers the *exact* Nickel Anodes you need *when* you need them...Ovals, Flats, Rounds and Special Shapes... rolled to your specifications ...delivered on time.

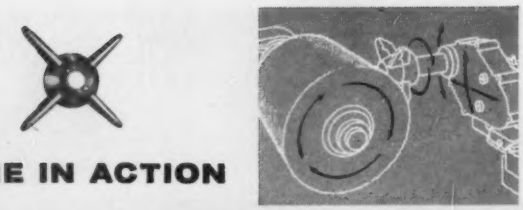
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Seaway Nickel...*a sensible source!*

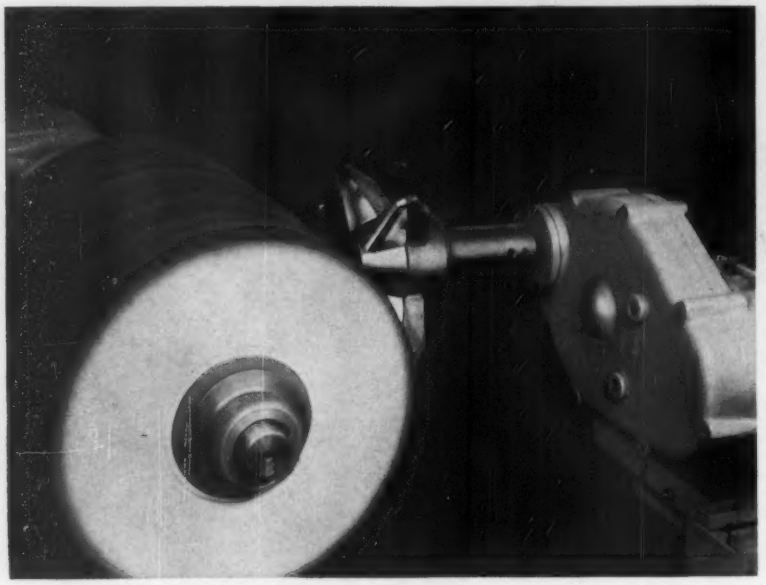


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ACME IN ACTION

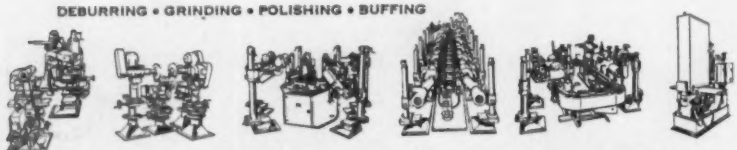


Doing more work with *Movement and Motion*

The die-cast part being "mush" buffed above happens to be an automotive accessory having recessed, contoured surfaces. But it could be almost any other type of limited production part presenting similar finishing problems because the equipment performing the operation is a versatile Acme Semi-Automatic Polishing and Buffing Machine. Note that the ruggedly built work holding unit has an adjustable horizontal stroke that distributes wear evenly across the buffing wheel. Note, too, that the exclusive Acme oscillating head attachment simultaneously rotates the part and moves it vertically above and below the center line of the wheel to assure maximum coverage, greater uniformity of finish. Matter of fact, this unique combination of movements and motions—this added Acme action—does so much more work so much better that two operations can often be combined into one!

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Comprehensive catalogs available upon request. Write, wire or call:

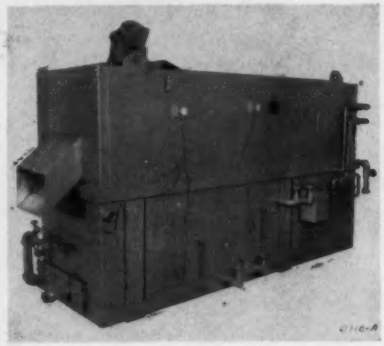
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Leading Producers of Automatic Polishing, Buffing and Deburring Machines Since 1910

Rotary Drum Degreaser

Metalwash Machinery Corp., Dept. MF, 901 North Ave., Elizabeth, N. J.



Model RDD rotary drum degreaser is a completely new small-parts degreaser designed for non-stop work in any automated production line without need for an operator or for load-unload delays. Its three-way action, combining solvent immersion, vapor-phase and continuous tumbling, thoroughly degreases all varieties of small parts, including cupshapes.

Smaller than conventional degreasers, it occupies ⅓ of the floor space required by conveyorized types. Its new, exclusive cooling system is on the drum itself. A specially-engineered revolving trough, through which flows a steady stream of cooling water, continuously condenses and returns solvent which may rise with the parts, assuring the most economical solvent utilization possible.

Dry Pickling Salt

Frederick Gumm Chem. Co., Inc., Dept. MF, 538 Forest St., Kearny, N. J.

Clepo 198-JA, a newly-developed powdered acid, contains catalysts to provide the additional pickling action necessary to remove the most stubborn scale deposits from ferrous metals. The performance is further enhanced by the inclusion of synthetic detergents in its formulation which suspend light oil residues and prevent them from floating on the acid solution. As a result, oil is not redeposited on clean parts when they are withdrawn from the solution.

The product also contains inhibitors which retard attack on ferrous metals and minimize acid consumption; however, this inhibiting effect will not interfere with subsequent plating operations, it is claimed. A light foam blanket is produced as the solution functions and acid fumes are eliminated.

Synthetic Pearl Pigments

Rona Pearl Corp., Dept. MF, E. 21st St. at E. 22nd St., Bayonne, N. J.

Synthetic Pearl Pigment Series 320 has the lowest degree of sulfide stain of any commercially available synthetic pearl pigment, it is claimed. Other outstanding properties are its excellent high heat stability, and luster and brilliance.

The pigment is available as a concentrate dispersed in dioctyl phthallate and vinyl solutions for use in vinyl film and coatings.

A new non-lead, synthetic pearl pigment powder, designated NLD, is free of all solvents, plasticizers, resins, and other vehicles. It is heat stable, nontoxic, and has a high degree of luster and brilliance and a comparatively low degree of sulfide stain. Concentrations of between ¼ to ½% produce excellent pearl effects.

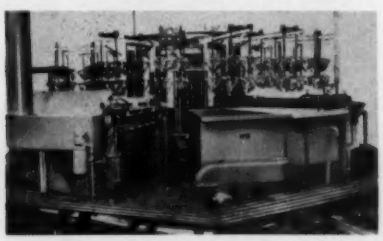
Automatic Plating Machine

Metallic Industry N. V., Dept. MF, Loosdrecht, The Netherlands.

A completely automated machine which carries out the entire cycle of operations required for galvanizing and other surface treatments of metals, performs the following sequence of operations: Suspension and removal, electrolytic degreasing, cold-rinsing, acid bath, cold-rinsing, plating, cold-rinsing, passivating (or acid bath), cold-rinsing, decolorizing (or chromium or brass-plating), cold-rinsing and finally, hot-rinsing.

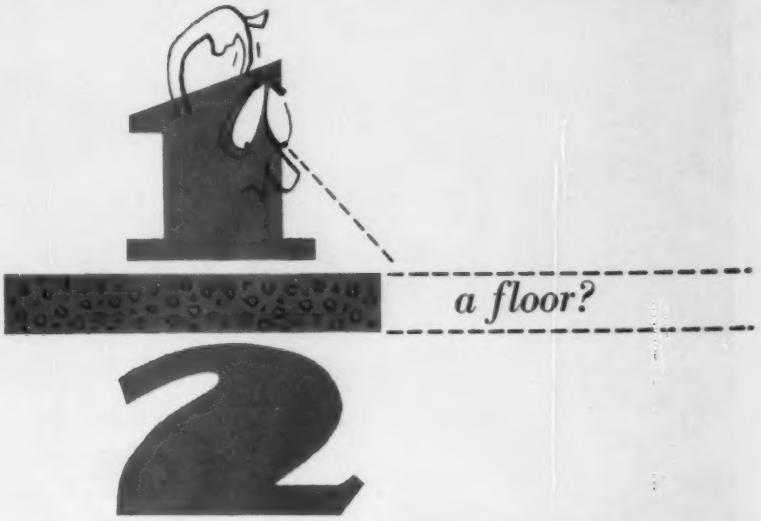
The automatic machine has a circular shape with a diameter ranging in various models from 13 to 19½ feet. The machine is eight feet high and is divided into 16 sections. Sections 6 to 10 form one large bath in which the actual treatment of galvanizing or cadmium or nickel-plating occurs.

One of the principal features of the machine is the central arrangement of the mechanism for automatic transport of the racks with the articles to be treated through the baths and over the bath rims. The baths are arranged in



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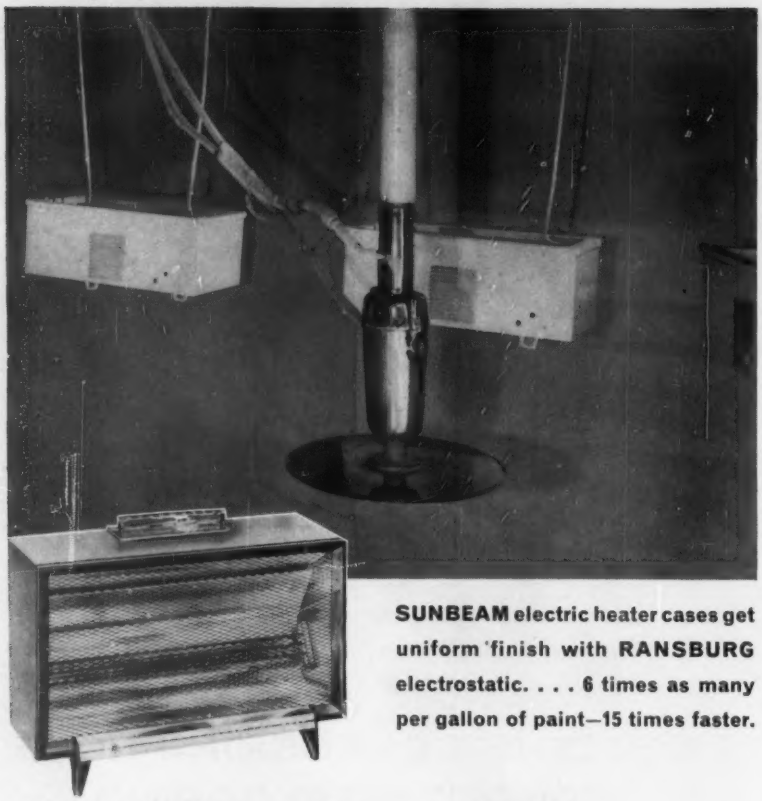
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SUNBEAM electric heater cases get uniform finish with RANSBURG electrostatic. . . . 6 times as many per gallon of paint—15 times faster.

"Paint Mileage Leaps 500%.... Production Upped 15 Times" Reports ENAMELED STEEL & SIGN CO.

Curt Simmons, President, ENAMELED STEEL & SIGN COMPANY of Chicago, describes results with RANSBURG Automatic No. 2 Process Electro-Spray: "We first painted cases for the new SUNBEAM portable electric heaters with air hand spray at the rate of 200 pieces per day using 6 gallons of paint. Now, with RANSBURG electrostatic we've increased production 1400% to 3000 pieces daily with only 15 gallons of paint." An increase of 500% in paint mileage! *What would savings like this mean in your finishing department?*

QUALITY IMPROVED WITH RANSBURG ELECTRO-SPRAY

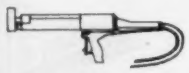
Sags and runs, a problem with the air hand spray, have been eliminated with the automatic electrostatic equipment. Mr. Simmons adds: "Now we achieve a uniformity over the configurated area which wasn't always possible before. We know the 50,000th piece will turn out the same as the first."

ENAMELED STEEL—sold on the efficiency and versatility of RANSBURG Electro-Spray—uses 14 automatic No. 2 Process units to meet the heavy demands of their diversified, high volume production.

NO REASON WHY YOU CAN'T DO IT TOO

Manufacturers—large and small—are reporting similar savings in paint and labor with increased production. If your volume doesn't justify automatic electrostatic equipment, perhaps the RANSBURG electrostatic hand gun will help cut costs in your finishing operation. Write for our new brochure showing actual in-plant production photos, savings figures and detailed information on RANSBURG No. 2 Process Electro-Spray.

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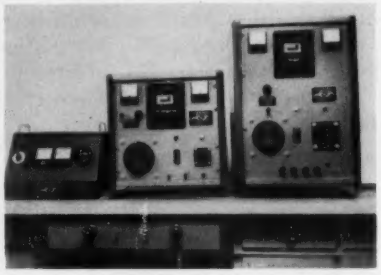
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a circle around the automatic mechanism. A lift moves up and down a central stand. A turntable around this lift consists of vertical guide faces along which the guides move, carrying the rods from which the racks are suspended.

The lift carries along each guide supported on a roll on the lift. The guides are then transferred in a horizontal direction over the bath rim to the next position. This cycle of raising, turning and lowering is repeated constantly.

Selective Plating Power Packs

Selectrons, Ltd., Dept. MF, 153 E. 26th St., New York 10, N. Y.



Two new power packs are specially designed for selective electroplating.

The portable unit (model 1520) weighs 35 lbs. and operates on 110 volt, 60 cycle. D-C output is variable from 0-15 amp. at 0-20 volt, to suit the needs of the particular application.

Model 2530, being semi-portable, is particularly useful for research and development, prototype work, and light production. A-C line voltage is converted to 0-25 amp, 0-30 volt D-C output. A fine voltage control and a totalizing ampere-hour meter with 0.002 amp.-hr. divisions permit precise control of deposit thickness.

Furnished with a dolly. the heavy production model 6035 is easily moved from one plant location to another. Input voltage is 220 volt, 60-cycle, single phase; D-C output is 0-60 amp. at 0-35 volt. This unit is also furnished with a precision totalizing ampere-hour meter. Designed primarily for large styluses, the power pack has twin sets of leads for simultaneous use by two operators.

Tank Linings and Flooring

Ceilcote Co., Dept. MF, 4844 Ridge Road, Cleveland 9, Ohio.

Four different corrosion-proof tank linings and flooring compounds, varied to meet specific requirements and con-

ditions, are now available from the above company.

Coroline 505 is a troweling compound based on a modified epoxy resin. Combined with a graded silica filler, cured with polyamine type hardening agent and reinforced with glass fabric, this resin is used as a lining for tanks, pits and foundations. It provides protection of concrete and steel from corrosion. Maximum service temperature ranges from 180° to 200°F. depending on chemical conditions.

Coroline 510 is another compound based on epoxy resin. This resin is combined with graded carbon filler and is also cured with polyamine hardening agent. Usually reinforced with glass or synthetic fabric, the material is used as a lining, $\frac{1}{8}$" to $\frac{3}{16}$" thick for protection of concrete and steel from corrosion. It can also be used as a spark-proof and electrically conductive flooring. Maximum service temperature ranges from 130° to 220°F.

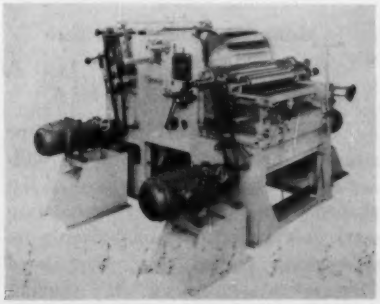
Coroline 525, formerly known as Ceilcote E-13-A, consists of a thermosetting plastic resin and fiber glass cloth. This lining, perfect for steel vessels, is applied by brush and cures at normal temperatures to a tough, flexible, impervious film approximately 30 mils thick.

Coroline 530 is also a troweling compound used for protecting concrete and steel from corrosive chemicals. It is a three-component system consisting of a liquid plastic, a plasticizing hardener and a graded silica filler. Good resistance to thermal shock is provided for by a thermosetting resin base composition with thermoplastic properties. Tolerances for dampness and moisture during application is better than with other products in this group.

Roller Coater

Gasway Corp., Dept. MF, 6463 N. Ravenswood Ave., Chicago 26, Ill.

Even paint distribution is accomplished in this machine by precision grinding of coating and doctor roll on





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Rust-Proofing Materials
Vapor Generators
Phosphate Coating Compounds
Paintbond Compounds
Extrusion and Drawing Compounds
Spray Booth Compounds
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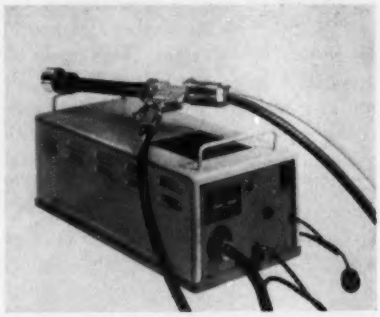
centers and then also operating them on centers in the coater itself instead of with journal boxes. In this way paint films can be metered to extremely close tolerances, producing superior painting results with very thin films. The precision coater is also designed to prevent undue loss of metal stock in the form of scrap and loss of production during changing of rolls. With the new coater it is possible to change rolls quickly (average time 60 seconds) because the machine has been designed with retractable centers which may be moved away or brought up to the roll in very much the same way this operation is performed on the tailstock of a lathe.

A further design incorporated into the machine to maintain precision control of the paint film is the conical-headed construction of the large back-up rolls, which replaces the flat head formerly used and provides a highly rigid roll not subject to deflection under the high tension of the strip against it. This helps maintain a constant film contact along the coating roll and also tends to eliminate irregularities caused by the "oil-can" wavy imperfections sometimes found in even the highest quality mill stock. Precise roll contact with the strip is maintained by hydraulic cylinders controlling the roll-carriage from a central point. This, together with the internal bracing of the carriage, maintains equal contact along all parts of the coating rolls for uniformity of film thickness.

The paint fountains are interchangeable. This eliminates the need for washup of the machine "on-line" and permits faster color changes.

Electrostatic Spray Gun

Sames, Dept. MF, 30 Broad St., New York, N. Y.



A new electrostatic hand spray gun, the Stajet, consists of an electrostatic generator delivering an absolutely harmless voltage of 90,000V and current up to 0.2MA, a spray gun with an anti-sparking head, and a powder reservoir with vibrator.

Advantages of the equipment are its noise-free operation, small power consumption (only 100 watts), and its adaptability to factory or field work. The generator delivers very nearly maximum voltage (85,000V) at full load current. This permits maximum particle charging at the maximum rate of coating flow. Low electrical capacitance and short circuit current limited to little more than maximum current (0.22MA) completely eliminates the danger of high voltage shock.

A patented anti-sparking head provides the safety necessary to work with burnable powders. Made of solvent resistant plastic, the head rim is unbreakable and distortion-free. Semiconducting elements eliminate all sparking and guarantee complete safety.

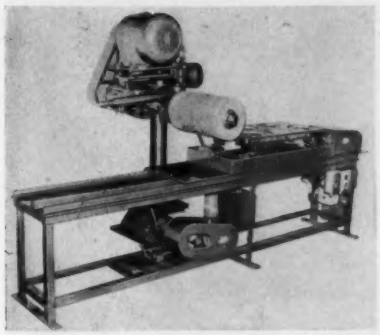
Automatic Buffing Machine

Acme Mfg. Co., Dept. MF, 1400 E. Nine Mile Road, Detroit 20, Mich.

A new automatic reciprocating type straight line buffing machine for buffing and satin finishing surfaces of flat shaped parts, consists of an oscillating work holding fixture mounted on a reciprocating platen. A floating head fully adjustable heavy duty buffing

lathe performs the finishing operations as the part is reciprocated and oscillated under the buffing wheel. A solenoid-operated timer control permits the work to reciprocate under the wheel for a predetermined time cycle.

The oscillating fixture provides uniform wheel wear, eliminates buff streaking and permits the use of buffing lathes that do not incorporate stroking type-spindles. The motor-driven and mechanical actuated fixture oscillates a



total of ¼-in. at a speed of 200 oscillations per minute.

The reciprocating platen is actuated by a motor driven rack and pinion arrangement. The platen has an adjustable travel actuated by a reversing controller and two limit switches. Platen speed can be varied with a 3 to 1 variable speed drive having a normal range of 5 to 15 feet per minute.

The adjustable lathe used on the machine can be equipped with interchangeable motorized drive units for automatic buffing wheel wear compensation to maintain correct finishing pressure throughout the life of the finishing member.

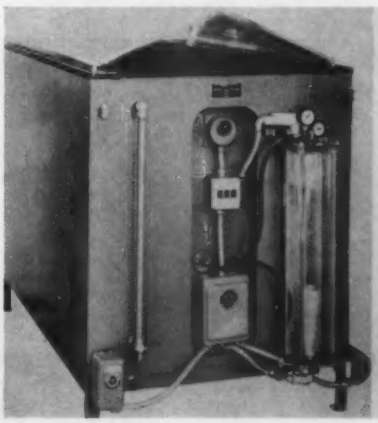
The machine illustrated is 24-inches wide, 14 feet long and satin finishes stainless steel stove tops. The length of the machine is dependent on the type and size of part to be finished.

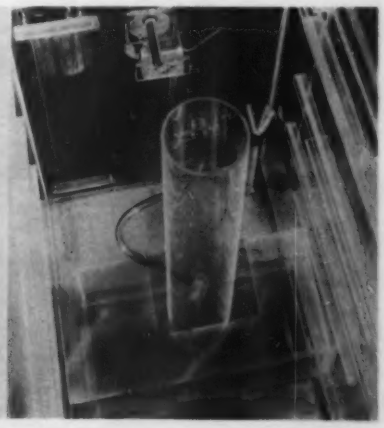
Corrosion Test Cabinets

Singleton Co., Dept. MF, 11770 Berea Rd., Cleveland 11, Ohio.

Nearest to 100% uniform accuracy of test results by any such apparatus is the claim for the new line of "Optimist" corrosion test cabinets. Featured is the firm's in-cabinet, moveable fog generator-solution reservoir. The generator tube stands upright in the reservoir, which water-seals the bottom against fog recirculation and other causes of variables. Solution and cabinet temperatures are constant. It adapts to old and new cabinets, and is of simple, low-cost construction.

As an alternate to the generator, a 3-dimensional fog baffle, adjustable





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for directing fog as desired is attached to reservoir cover. A recently developed plastisol cabinet lining offers permanent protection against all test hazards and all known solutions.

Also spotlighted are reversible full-vision cabinet lid; removeable, coated specimen racks; 3-way simple controls centralized in recessed panel; full-coverage water jackets (temperatures to 170°F. $\pm\frac{1}{2}°$); water seal lid gutters, and many more.

Cabinets are available in small to king-size models, plastisol-lined stainless, plastisol-lined plain steel, transparent H-T Plexiglas, for heavy-duty service, condensing or non-condensing.

Buffing Compound Cleaner

Mitchell-Bradford Chem. Co., Dept. MF, Wampus Lane, Milford, Conn.

"Buf-Comp Remover" is a new cleaner designed specifically for removing buffing compounds which heretofore have caused stubborn cleaning problems. It is a combination of the latest developments in liquid detergents and penetrants. It is used 2 to 5 ounces per gallon of water and operated at or above 160°F.

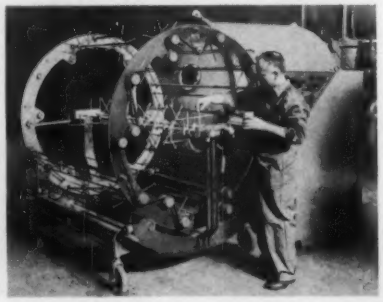
The action of the cleaner is to penetrate under the buffing compound, dissolving soluble compounds and loosening insoluble ones, which will peel off, or fall off by slight agitation in the cleaning solution, or in the final rinsing.

The material can be used for cleaning steel, copper and copper alloys, zinc, aluminum, and many other types of metals and electroplated surfaces. It is available in 5 gallon pour spout containers or 55 gallon non-returnable drums.

Vacuum Metalizer

F. J. Stokes Corp., Dept. MF, 5500 Tabor Road, Philadelphia 20, Pa.

The work-holding planetary carriage of the new 72-inch vacuum metalizer, Model 427-6, has been redesigned so that it can now accommodate ten 16-inch diameter reels at once, with a full 54 inches of usable length on every reel. When this is multiplied by the total number of daily loads, it gives a considerable increase in load-handling capacity.



Small Tumbling Machine

Grav-i-Flo Corp., Dept. MF, Sturgis, Mich.



Versatile, the PD-10 can be used for cob meal or sawdust drying of metal parts, as well as deburring and burnishing, or cleaning operations. Weighing about 160 lbs., the machine has a cylinder capacity of 6 cubic feet and is furnished with either $\frac{1}{3}$ or $\frac{1}{2}$ H.P. motor drives.

The unit is of fabricated steel construction with a simple lock pin mechanism, allowing three tilting positions, load, unload, and running. Although the cylinder is furnished unlined as standard equipment, neoprene lined cylinders are available.

A separating bin, generally used to separate sawdust or cob meal from metal parts, is available with the unit. The bin size is $14\frac{1}{2}$" high x 38" wide x 41" long, weighs about 60 lbs. and uses a variety of mesh size screens.

Metal Etch Primer

Hartin Paint & Filler Corp., Dept. MF, 15-16 129 St., College Point 56, N. Y.

Hartite metal etch primer, available in zinc chromate, will phosphate treat and prime in one simple operation. The metal surfaces require no special treatment other than normal cleaning. Application is by conventional spray or dip.

The primer air dries in minutes and can be followed immediately with any baked enamel, vinyl or lacquer and baked in one operation, it is claimed.


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SUBMERGED FILTER SYSTEMS
with totally enclosed, ball-bearing, continuous duty, fan-cooled, 3400 r.p.m., 1/4-1/2 h.p., brushless AC motor.
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OVERHEAD UNDER FOOT?

precious-metal scraps, sweeps, solutions and shavings are a form of reducible overhead you may be neglecting simply because you regard them as mere shop wastes instead of the potential "buried treasure" they really are. Money hides in:

Turnings, chips, shavings	Blanking scrap
Anode ends	Filter pads
Chemicals	Contact alloy scrap
X-ray film	Coated plastics, glass, etc.
Brazing alloy scrap	Plating solutions
Bimetals scrap	Platinum-bearing materials

Once you've collected your valuable wastes from under foot, you'll want to send them where you'll get highest returns. Handy & Harman has the well-earned reputation for getting the most out of refinings, regardless of form. Try us and see. And send for our Bulletin 24—it's full of tips on *how to turn trash into cash.*

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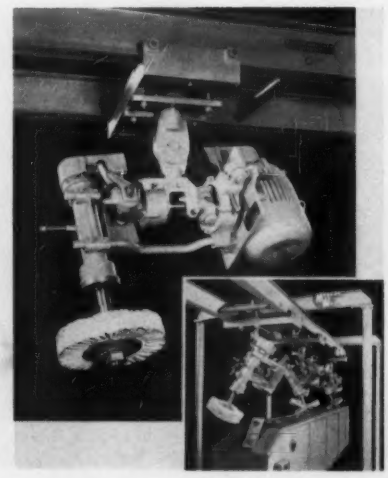
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Overhead-Mounted Buffing and Polishing Heads

Murray-Way Corp., Dept. MF, P. O. Box 180, Birmingham, Mich.

Full wheel contact with irregular work shapes, where a combination camber in two planes is involved, may now be achieved with fewer heads and a smaller work space requirement using #052 overhead-mounted full universal buffing and polishing heads.

The overhead-mount feature effects a great saving in floor space. They may be placed much closer together than floor-mounted heads which require clearance for adjustments by the operator. Easy access is afforded to both conveyor and heads, and clean-up is greatly simplified.



The head utilizes two fulcrums, affording a more flexible, universal-type movement of the work wheel, enabling it to follow closely an irregular shape in two planes simultaneously. Two simple fulcrum adjustments determine the degree of angularity and accurately position the wheel.

The head has a capacity up to 20 HP. The wheel spindle incorporates heavy-duty, anti-friction bearings which require no grease or oil and are sealed against dirt for cool, trouble-free performance. The automatic motor mounting adjustment keeps proper tension on the drive belt at all times, and a spindle lock makes wheel replacement simple and convenient.

Heads are easily raised or lowered over the conveyor by means of a threaded stud and nut. The carriage which supports the heads may be moved "in line" or at a right angle to the conveyor path. Adjustable stops control float of the heads.

Counterweights and brackets which balance spindle side with motor side of head, push button compensation for work wheel wear, and remote-control wheel lift-off are available as optional accessories.

BUSINESS ITEMS

Metal & Thermit-Udylite Announce Proposal to Merge

H. E. Martin, chairman of *Metal & Thermit Corp.* and *L. K. Lindahl*, chairman of *The Udylite Corp.* have announced approval in principle by both boards of directors of a merger between the two companies. The action is subject to approval by the directors of a formal merger agreement for submission to the stockholders of both companies. Udylite will continue under its present management as a division of Metal & Thermit.

Gerald Glab Joins Belke

Appointment of *Gerald P. Glab* as technical engineer in cleaning and plating service is announced by *Belke Mfg. Co.*, 947 North Cicero, Chicago 51, Ill.

Mr. Glab has had long practical experience in the process control laboratory of Automatic Electric Co. and Northwestern Plating Co. of Chicago. His formal education in chemical engi-



Gerald P. Glab

neering was obtained at Northwestern University School of Engineering and at the Illinois Institute of Technology.

Mr. Glab is a member of the A.E.S.

Stanley Appoints New York City Representative

Christopher J. McMahon has been appointed sales representative in greater New York City for the *Stanley Chemical Co.*, East Berlin, Conn.

Mr. McMahon comes to the firm from the Duralac Chem. Co., where he was sales representative for the past four years. Previously he was a representative for the Sherwin-Williams Co.

A native of Kearney, N. J., he attended schools in North Arlington, N. J. and St. Peter's College, Jersey City.

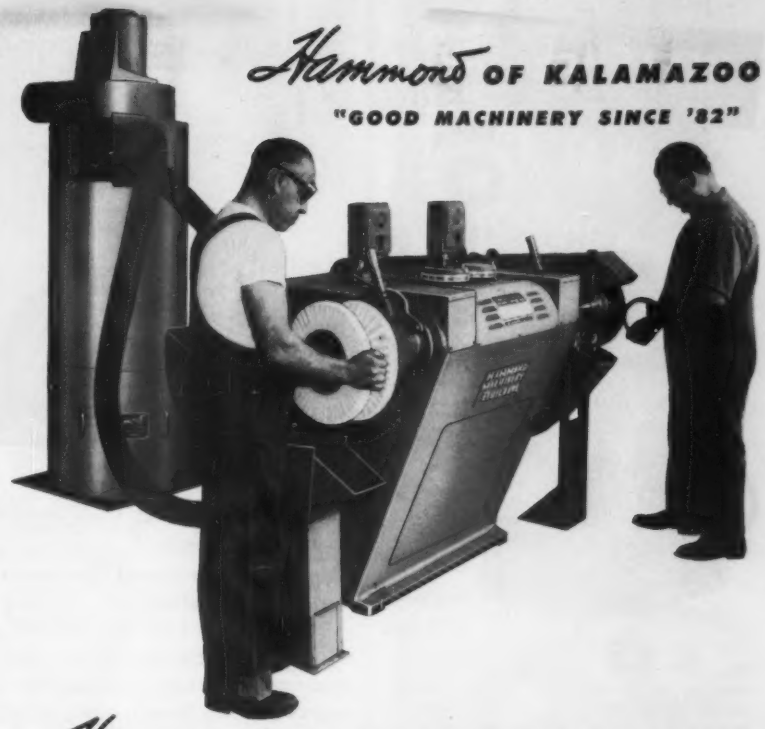
Wyandotte Announces Top Level Field Changes

Naming of a new district sales manager and reassignment of two others went into effect recently according to the J. B. Ford Division of *Wyandotte Chemicals Corp.*

John J. Wilson has been appointed as the Division's new district sales manager for its New York territory. For the past five years, he was field sales manager in the Philadelphia District.

James S. Hubbard, formerly the company's New York manager, transfers to manage Cincinnati operations. Hubbard took over the New York post in January 1959 and, for five years prior to that, was the Division's Boston district sales manager.

E. S. Schmeling moves from Cincin-



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Hammond MODERN SELF-CONTAINED GRINDER-POLISHER-DUSKOLECTOR

Reduce finishing costs — step up production with this modern, self-contained variable speed Grinder-Polisher with DusKolector.

Lathe has individual, variable speed dial control for each spindle. No "down time" for one operator when the other must increase speed or change wheel. Cyclone DusKolector requires little floor space. Backstand is one of 10 Air and Spring Tension Models to choose from.

Cost reduction through increased efficiency is the need of the day. Write for catalog showing America's most complete line of polishing and buffing machinery.

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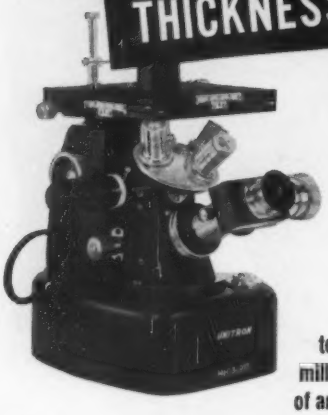
John J. Wilson



E. S. Schmeling

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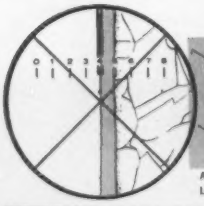


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UNITRON'S PL-MEC PLATER'S MICROSCOPE substitutes facts for uncertainty. The plated deposit is observed through a Filar Micrometer Eyepiece and measurements are read directly from a micrometer drum. This compact microscope is easy to use, portable around the shop and has a built-in light source. It also doubles as a metallurgical microscope for examining grain structure etc. at magnifications of 25X-1500X. Permanent photographic records may be made using an accessory 35mm. camera attachment and provide valuable legal protection for subcontractors.

UNITRON'S PLATER'S MICROSCOPE will save its initial cost many times over. Prove this for yourself — as so many firms in the plating industry have done—by requesting a **FREE 10 DAY TRIAL** in your own plant. There is no cost and no obligation.





Above: Accessory camera attachment.
Left: Observing the plated deposit.

$468 Model PL-MEC complete with all optics and standard accessories	As above with built-in camera attachment, but without 35mm. camera back: **$540**

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James S. Hubbard



E. H. Peterson

nati to fill a district sales manager vacancy in Chicago.

Magnus Names Board Chairman and New President

The election of *W. M. Campbell* as chairman of the board and *E. H. Peterson* as the new president was announced at the annual board meeting of the *Magnus Chem. Co., Inc.*, Garwood, N. J.

Mr. Campbell, who founded the company in 1921 to manufacture and market industrial cleaning compounds, has served as its president and chairman of the board since the company's inception.

Mr. Peterson becomes the company's chief executive officer. Associated with the firm since 1947, Mr. Peterson has held the position of assistant to the president and general sales manager. Since 1960 he has had the title of executive vice-president. He also is a member of the board of directors and chairman of the executive committee.

Elected to two newly created offices were *R. W. Mitchell* as 1st vice-president and *W. A. Mays* as 2nd vice-president. Re-elected were *A. W. Bowling*, secretary and *W. M. Garbe*, treasurer.

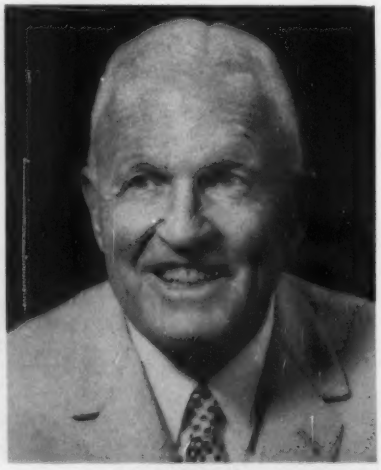
New Representatives Appointed by Oakite

Oakite Products, Inc., has appointed *Richard F. Latt* and *Donald F. Moulton* members of the company's field service organization.

Mr. Latt, a graduate of the University of Vermont, will serve the metal industries in the South Buffalo, New York area.

Mr. Moulton, a graduate of the University of New Hampshire, where he majored in chemistry, has been assigned to the state of Vermont.

Both men completed an intensive eight-week training program at the firm's New York laboratories and in



W. M. Campbell



Richard F. Latt



Donald F. Moulton



R. A. Bernabo

the field before undertaking their new assignments.

Osborn Names Brush Division Sales Manager

Glenford M. Shibley has been named sales manager, Brush Division, *Osborn Mfg. Co.*

Three Executive Appointments Announced by M&T

Three executive appointments have been announced by *Metal & Thermit Corp. Leonard W. Mawhinney* has been named a vice-president; *R. A. Bernabo* has been elevated to corporate secretary; and *E. J. Robesch* has been appointed assistant controller and assistant secretary.

Mr. Mawhinney joined the firm in 1959 as executive advisor to the president. Previously, he was associated with Ford Motor Co. and Continental Can Co. with product planning and budget and cost control assignments. He received the B.S. degree in mechanical engineering from Pennsylvania State College. During World War II he was an ordnance specialist and a lieutenant in the U. S. Navy.

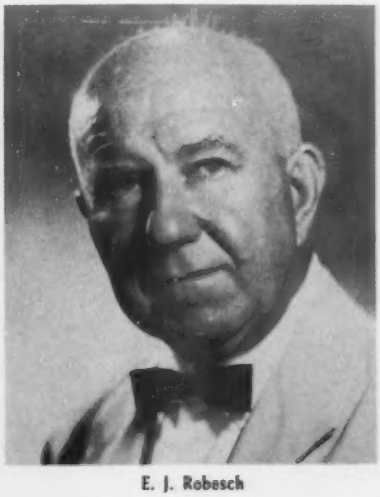
Mr. Bernabo joined the company in 1958 as house counsel. He subsequently assumed the additional duties of assistant secretary. He is a member of the Association of the Bar of the City of New York.

Mr. Robesch joined the company in 1918 as an accountant. He previously was associated with Lybrand, Ross Brothers & Montgomery. In 1944 he was named a division head, and in 1957 appointed assistant to the controller.

A graduate of Pace Institute, New York, where he studied accounting, he took further studies at New York University. He is a member of the National Association of Accountants.



L. W. Mawhinney



E. J. Robesch

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Magnus, a specialist in cleaning and finishing, provides a unique combination of better plating results with lowered costs. How? By means of specialized compounds, methods and equipment.

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A Complete Line of Equipment Including Mechanically Agitated Machines, Soak Tanks, Spray Washers, etc.

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Paints, Finishes, Cleaners and Lubricants to Meet all Your Maintenance Needs.



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Company_____

Position_____

Address_____

City_____ State_____

Ross Engineering Names General Sales Manager

George F. Schuning was recently named general sales manager of the J. O. Ross Engineering Div., *Midland-Ross Corp.* One of the chief responsibilities in his new position is the management of the eight sales offices across the U.S.A.

Mr. Schuning received his chemical engineering degree from the University of Wisconsin. In 1959 he received a Sloan fellowship for executive development and, after obtaining his master's degree in industrial management at M.I.T. in 1960, served as manager of the Boston office.

Schuning is a member of the American Management Association, American Institute of Management, Technical Association of Pulp & Paper Industry, as well as several national honor societies.

Brown Joins Frederick Gumm Chemical Co.

Frederick Gumm Chem. Co., Inc., of Kearny, N. J., has announced the appointment of *William H. Brown* as technical sales representative in the Philadelphia-Trenton-Camden area, as well as Maryland and Delaware. Mr. Brown has acquired a wide background in the metal finishing industry as sales engineer for Hanson-Van-Winkle-Munning Corp., and previously with Seydel Chem. Co.

A veteran of World War II, Brown attended Columbia University, majoring in Chemical Engineering, and Rutgers University where he studied Sanitary Engineering. He is an active member of the Philadelphia Branch of the A.E.S. His office will be located at 2536 North Parkview Drive, Norristown, Pa.

New Company Formed in Italy

Rumianca, S.p.A., a chemical manufacturer of Turin, Italy, and *Pittsburgh Plate Glass International S. A.*, have formed *Chimica Sarda S.p.A.*, as a jointly-owned company.

The new company, to be located in Sardinia (Italy), will manufacture glycerine, trichlorethylene, perchlorethylene and ethylene dichloride by processes developed by the chemical division of Pittsburgh Plate Glass in the United States.

Ionic Electrostatic Corporation Expands Sales and Service Facilities

Ionic Electrostatic Corp., manufacturers of electrostatic spray systems, recently granted a sales and service franchise for the states of New Jersey and New York to *Ionic Eastern Corp.*, 120 Park Ave., Rutherford, N. J.

The new sales and service organization is presently staffed with 10 technical representatives thoroughly trained at Ionic's research laboratory to enhance customer relations and provide immediate attention to their requirements.

Detrex Appoints Camel Vice-President

The board of directors of *Detrex Chemical Industries, Inc.* has elected *Leroy Camel* as vice-president. He joined the firm in 1936 as technical director of the Alkali Division. His recent assignment has been sales manager of the Chemical Processing Division. He will continue with this responsibility.

DeSoto Chem. Coatings, Inc. Enters into Agreement with Overseas Firms

DeSoto Chemical Coatings, Inc., Chicago, has announced the completion of technical agreements with *Coates Brothers & Co. Ltd.*, London, England, and *Societe Anonyme Des Etablissements Georget Fils*, Nantes-Chantenay, France.

The agreements with the two overseas coating companies provide for a free exchange of technical information and use of formulas pertinent to the field of metal container coatings.

Timesavers Sanders Completes Plant Expansion

Timesavers Sanders, Inc.'s new plant addition at 5270 Hanson Court, Minneapolis 22, Minn. is a single story 90′ x 100′ concrete-block building that will serve as assembly, research and demonstration facilities for the company.

The present plant facilities will be utilized for expanded machine shop operations, parts warehouse and material storage.

Singleton Promotes McGinnis

Headlining a rapidly accelerated sales expansion is the promotion of sales manager *Mark A. McGinnis* to vice-president-sales of *The Singleton Co.*, Cleveland, Ohio. He has managed sales for the firm since the reorganization in November 1960 when R. O. Hull & Co. acquired its interest.

In addition to continuing his man-



William H. Brown



Leroy Camel



Mark A. McGinnis

agement of equipment sales, McGinnis will be administrative head of his department, directing policy, advertising and expanding distribution.

Hull Promotes Beckwith, Stuart, and Friede

Launching its largest expansion program in 16 years, *R. O. Hull & Co., Inc.*, Cleveland, has named *Dr. Merton M. Beckwith*, vice-president and technical director, *Paul R. Stuart*, vice-president and general manager, and *Walter Friede*, manager of its customer service laboratory.

Dr. Beckwith joined the firm after 25 years in the metal finishing industry, the last 15 with Harshaw Chem. Co., where he had advanced to Electroplating Division manager, supervising research and development, field service, and other activities of that division. He also supervised all foreign electroplating activities for the firm. He is well known as author and speaker on developments and practices in electro-finishing and plating. He has twice won the annual Dorothy Hermine Proctor Award of the A.E.S. Dr. Beckwith is also a member of the A.S.T.M., A.S.M., The Electrochemical Society, Institute of Metal Finishing (British), Phi Lambda Upsilon (Chem. honorary), Sigma Xi (Science honorary), and Alpha Chi Sigma.

Stuart, ten years with the firm, advanced from office manager to general manager; then to his present post of vice-president and general manager of the firm's five establishments. He is a member of American Institute of Management, National Association of Accountants and other groups.

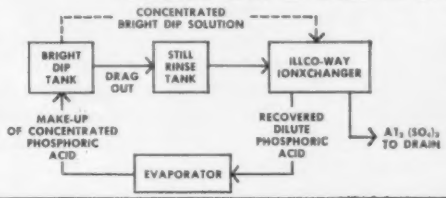
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ILLCO-WAY ionXchange

SPECIALIZED EXPERIENCE SHOWS HOW TO SAVE MONEY

The use of ion-exchange eliminates the need for dumping expensive phosphoric acid. Four years of successful experience in recovery of bright dip solutions enables us to make several recommendations, depending on particular conditions. Usually, we employ a cation exchanger to purify the first rinse, recovering phosphoric acid which has been carried over from the bath by dragout. Another treatment removes aluminum direct from the bath. The use of IWT ionXchange can not only improve the uniformity of your product through better quality control in the plating, but also can be a very *profitable* investment.

PROCESS CAN BE USED IN SEVERAL WAYS



The block diagram at the left illustrates the general methods of treatment suggested above. Actually, every installation presents its own special problems — which IWT engineers are well-equipped to solve. *So, consult your IWT representative for specific suggestions.*

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CANADIAN DIST.: Pumps & Softeners, Ltd., London, Ont.



Dr. Merton M. Beckwith



Paul R. Stuart



Walter Friede

Mr. Friede is responsible for analytical work relative to solving special plating problems. Bringing technical service facilities closer to the field is part of his program. Prior to joining the company, Friede was a chemist at Brookhaven National Laboratories and, before this, was plant chemist for Circle Wire and Cable. He has a B.S. in Chemistry, experience in electroplating, and metal finishing, and plans graduate physical chemistry work in Cleveland. He holds memberships in American Chemical Society and the A.E.S.

Industrial Finishes Relocates

Industrial Finishes Co., Inc. announce the removal of their Philadelphia office to 2 Bryn Mawr Ave., Bryn Mawr, Pa. The new telephone number is LAwrence 5-1870.

SeaView Opens Baltimore Paint Plant

SeaView Industries, Inc. has announced removal of its $250,000 roller strip-coating paint line to a new plant in Baltimore, Md., where it will be operated by its subsidiary: *International Coating Corp.*

Bunting Brass and Bronze Co. Installs New Plating Dept.

The *Bunting Brass and Bronze Co.* has announced the creation of a new precision plating department and the appointment to head it of *Elmer T. Blackney,* a graduate chemist with over sixteen years' experience in the precision plating field.

The new department will be fully equipped to perform close-tolerance plating of sleeve bearings and other parts by either the electrolytic or immersion process. Precision being of paramount importance, elaborate precautions have been taken to insure extreme accuracy.

Mr. Blackney, following graduation in 1939 from Michigan State University, was with such organizations as United Chromium, Knight - Morley Corp., C. M. Hall Lamp Co., and Detroit Die Casting Co.

Pennsalt Announces Appointments

Robert M. Burford, Oscar Maxstadt, and *Bernard C. Voltz* have been appointed to newly-created equipment sales posts in the Metal Processing Department, *Pennsalt Chemicals Corp.*



Robert M. Burford



Bernard C. Voltz

Burford, named supervisor of equipment sales, moves to his new assignment from Cleveland where he was district manager. He joined the firm in 1947 as a metal processing salesman in Erie, and subsequently held district management positions in Buffalo, Pittsburgh and Cleveland. He is a graduate of the University of Pittsburgh and a member of the A.E.S. & M.F.S.A.

Maxstadt becomes supervisor of design engineering within the equipment group. He joined the firm in 1959, following several years as a chief draftsman and project engineer in the missile and aircraft field. He is a graduate of Ohio Mechanics Institute.

Voltz, who joined the company early this year, has been appointed supervisor of installation and inspection within the equipment group. He brings to his new assignment many years' experience in machinery engineering in the metal washing equipment field. He attended the University of Cincinnati.

Bee Chemical Announces New Distributor

Bee Chemical Co., Lansing, Ill., has announced the appointment of *Chapman Chemical Co.,* Memphis, Tenn., as distributor in the states of Tennessee, Georgia, Alabama, Mississippi, Louisiana and Arkansas. This firm is noted for its technical advisory service in the metals finishing field.

Martusevich Joins Gumm

Frederick Gumm Chem. Co., Inc., of Kearny, N. J., announces the appointment of *Gregory P. Martusevich* as research chemist. Mr. Martusevich is a graduate of City College of New York and took his graduate degree at Newark College of Engineering, where his thesis was on anodic passivation of metal surfaces. He was formerly plat-



Oscar Maxstadt



Gregory P. Martusevich

ing supervisor at Electrotech Corp. and was previously with American Metal Climax Corp.

Farrington Sanford to Handle Research, Licensing Activities of Aluminum Hardcoating Process

Farrington Sanford, a division of *Farrington Mfg. Co.*, Needham Heights, Mass., has been created to handle the research and licensing activities of the recently acquired *Sanford Process Co. Inc.*, of Los Angeles, California.

The business and assets of the Sanford firm were acquired in August by Electralab Printed Electronics Co., a Farrington subsidiary engaged in the production of high quality printed circuits for the electronic industries.

Kerns United Moves Office

The executive, sales and general office facility of *Kerns United Corp.* has been moved to 824 State St., Calumet City, Ill., telephone 868-0200.

Enjay to Expand Solvents Capacity

Enjay Chemical Co., a division of Humble Oil & Refining Co., has announced plans to expand its line of solvents and chemical intermediates. New production facilities will be added at the Bayway, N. J., refinery. Methyl isobutyl ketone is the principal product that will be made in the new plant, which is expected to be completed and on stream by the middle of 1962.

Diamond Alkali Acquires Fiber Chemical

Acquisition of *Fiber Chemical Corp.*, Cliffwood, N. J., through an exchange of stock, has been announced by *Diamond Alkali Co.* A producer of organic chemicals and inorganic specialties, Fiber Chemical will be operated as a wholly owned subsidiary.

A. B. Tillman, Diamond's general manager, Soda Products — Chrome Division, has been elected president of the new subsidiary, and Fiber Chemical's facilities will be operated as a part of that division. *G. V. DuPont*, special staff assistant, will assume the responsibilities of vice president, and will be based at the Cliffwood plant.

Fiber's founder and president, *F. F. Axelrad*, will remain with the subsidiary as director of research and development.

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Borlet Joins M&T's Plating Division

Chester G. Borlet has been appointed plating products specialist for the Plating Division of *Metal & Thermit Corp.* He will be located at 1700 East Nine Mile Rd., Detroit 20, Mich.

Until recently Mr. Borlet was technical director of Grand Rapids Brass Co., Grand Rapids, Mich. He is a 1935 graduate of Kent State University, Kent, O., and has pursued further studies at both Western Reserve University in Ohio and at the University of Detroit.

At the 1961 national convention of the A.E.S. in June, Mr. Borlet was elected to the presidency of the society for 1961-1962, succeeding *Dr. W. Andrew Wesley* of the International Nickel Co. Previously, Mr. Borlet had served as third, second and then first vice-president of the A.E.S. from 1958 to 1961.

His career in the electroplating industry included service as a sales engineer, and then superintendent of New York-Ohio Chem. Co., followed by a position as manager of sales service with the Harshaw Chem. Co. Mr. Borlet next held a position as an M&T district sales manager on the West Coast and was last affiliated with McGean Chem. Co. in the Detroit area.

He is also a member of The Electrochemical Society and the American Society for Testing Materials.



Chester G. Borlet

Kelite Appoints Martin

Kelite Corporation has announced the appointment of *Charles J. Martin* as Eastern regional sales manager. Overseeing sales on the eastern seaboard, he will have headquarters in the Berkeley Heights, N. J. facility.

His career in sales started with W. H. Harman Corp., steel fabricators, where he was first a sales engineer and then a district sales manager. For the last fourteen years he has been associated with Wyandotte Chemicals Corp.

A native of New York City with sales and sales management experience in the eastern and midwestern states, he has been a member of a number of trade and business organizations, including Sales Executive/Marketing Club, A.E.S., Illinois Dairy Producers Assn., Food and Beverage Executives Assn., and National Assn. of Sanitarians.



Charles J. Martin

Twin City Testing Corp. to Manufacture and Distribute Thickness Gauge for Boeing Associated Products

A lightweight, inexpensive electronic thickness gauge that uses radiation to measure metal films as thin as one ten-millionth of an inch will be soon on the market as the result of an agreement signed by Boeing and *Twin City Testing Corp.*, Tonawanda, N. Y. Under the agreement, Twin City Testing will have exclusive manufacturing and sales rights in the United States and Canada and will offer the new product in addition to its line of nondestructive testing equipment. The new gauge will be portable, and is expected to be in production within a few months.

Boeing developed the film gauge to measure extremely thin gold deposits on printed circuit boards and for other uses, such as the measurement of very thin rhodium films vaporized on a sapphire base. Instruments having the required accuracy were not available commercially at that time.



Boris B. Joffe, (left) president of Twin City Testing Corp., and H. W. Haynes, vice president and controller of the Boeing Co.

The agreement was made with *Boeing Associated Products*, an agency formed early this year to find outlets to the commercial market for many of the aerospace firm's inventions and discoveries.

Manufacturers' Literature

Polishing Plastics

Lea Mfg. Co., Dept. MF, 16 Cherry Ave., Waterbury 20, Conn.

A new technical data sheet on abrasive finishing methods for thermoplastic and thermosetting plastics gives complete data on abrasive grits and grades, wheel speeds, type of buff recommended and buff speed and surface speed.

Caustic Soda Safety Rules

Solvay Process Div., Allied Chemical Corp., Dept. MF, 61 Broadway, New York 6, N. Y.

A new wall chart listing safety precautions in handling anhydrous caustic soda, A-119 clearly specifies the four measures that should be followed to avoid accidents when using caustic soda. The chart also offers first aid instructions.

Molded Polyethylene Tanks

Apex Reinforced Fibre-Glass Div., White Sewing Machine Corp., Dept. MF, Washington & Elm Sts., Cleveland 13, Ohio.

Unbreakable, corrosion-resistant molded polyethylene tanks in standard sizes or custom-produced to specifica-

tions are described in a new two-page, two-color bulletin APT-5-61. Both rectangular and cylindrical shapes with straight sides are shown.

Prices and specifications are given for single units and quantity lots for the eleven standard sizes of molded polyethylene tanks, ranging in capacity from 10 gallons through 350 gallons for service up to 180°F.

Iron Phosphating

Northwest Chemical Co., Dept. MF, 9310 Roselawn, Detroit 4, Mich.

A brochure has been made available on Interlox, a corrosion resisting under-coat used as a pre-paint treatment for steel. It describes the firm's iron phosphating compounds and gives information on the operation of a phosphating line.

Chromate Conversion Coating

MacDermid, Inc., Dept. MF, Waterbury 20, Conn.

MACro Bronze No. 4, a new chromate conversion coating in dry powder form for zinc and cadmium that provides the high corrosion protection of olive drab is fully described in Technical Data Sheet No. 130.

DC Power Supplies

Meaker Co., Dept. MF, Nutley, N. J.

This 56-page guide describes semiconductor power rectifiers for every ac to dc application. Requests should be on company letterhead, indicating whether electroplating or industrial power supplies literature is wanted.

Electric Immersion Heaters

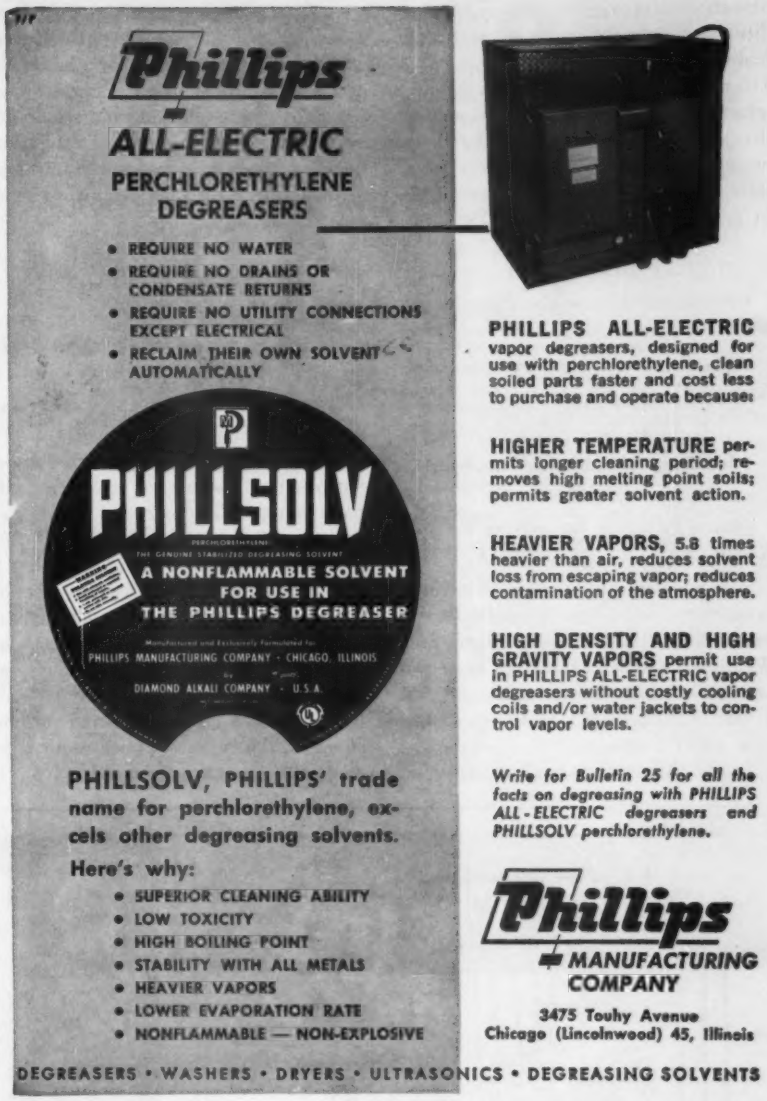
New Jersey Thermex Co., Inc., Dept. MF, 533 Bergen St., Harrison, N. J.

Catalog #SB-10 explains completely and clearly the salient features of SB and SSB Therm-X-Red immersion heaters. In addition to the informative technical data, there are photographs and precise illustrations of the heaters and their component parts.

Industrial Ion Exchange

Rohm & Haas Co., Resinous Prod. Div., Dept. MF, Washington Square, Philadelphia 5, Pa.

Thirteen case histories of installations using Amberlite 200 cation exchange resin are reported in a technical bulletin. Examples include softening, deionization and special applications in aggressive and oxidative streams and demonstrate the exceptional chemical and physical stability under a variety of extreme conditions.



Industrial Gloves

Wilson Rubber Co., Industrial Div., Dept. MF, 1200 Garfield Ave., S.W., Canton 6, Ohio.

Literature describing the new Wil-Gard Tru-Touch disposable vinyl industrial glove is available from the above manufacturer.

Chromium Plating Facilities

Whyco Chromium Co., Inc., Dept. MF, Waterbury Road, Thomaston, Conn.

A completely new insight into the advances made in chromium plating techniques through continuous research is presented in a recently published brochure, "Chromium Plating of Small Parts."

Photographs and descriptions provide the reader with a complete look at every department of the company, which processes more than 15 million parts every week.

Electroless Plating Processes

Enthone, Inc., Dept. MF, 442 Elm St., New Haven 8, Conn.

A four-page illustrated brochure describes chemical plating baths for depositing nickel, copper, or silver on a wide variety of substrates without electric current.

The brochure contains a brief ex-

planation of chemical plating, in addition to introducing the particular features of Enplate Cu-400 copper, Ni-410 nickel, Ag-420 silver, and the pretreatment products of the process. The brochure lists the many specific cycles developed for plating on plastics, ceramics, glass, and other non-conductors, in addition to metals and alloys.

Rectifiers

Continental Electronics Corp., Dept. MF, 757 Garden Rd., Columbus, Ohio.

A leaflet gives the significant features and advantages of the above firm's power converters.

Cleaning Aluminum for Spot Welding

Oakite Products, Inc., Dept. MF, 118 Rector St., New York 6, N. Y.

A completely new, 8-page, illustrated booklet entitled "The Chemical Preparation of Aluminum for Resistance Welding," discusses cleaning in preparation for deoxidizing, cold and hot deoxidizing, and etch-cleaning, to obtain a mat finish.

In addition, the booklet contains complete, detailed outlines for four specific weld preparation procedures, numerous suggestions for achieving the best welding results, a procedure for deoxidizing sheet stock, capsule descriptions of seven products which are recommended in the booklet and an explanation of the importance of rinsing and drying.

Degreasing Equipment

Uddeholm Co. of America, Inc., Dept. MF, 155 E. 44th St., New York, N. Y.

The correct selection of the vapor, spray, or immersion methods of degreasing are discussed in relation to various applications, in a 4 color, 16 page booklet. Photographs show several types of standard design and custom-built degreasing units, including a unit for continuous degreasing of cold rolled strip or spring steel. The manufacture of trichlorethylene, specifications, purity standards and physical properties are described. Safety factors built-into the equipment, and the effects of the vapors of trichlorethylene on health are also discussed.

Industrial Finishes

Titanine, Div., Seagrave Corp., Dept. MF, Union, N. J.

A twenty-page brochure on government specifications for the firm's industrial organic finishes is divided into three sections — general product suggestions, product descriptions, and government specification product list.

Metal Cleaning

Nox-Rust Div., Daubert Chem. Co., Dept. MF, 4700 S. Central Ave., Chicago 38, Ill.

A newly-published, 12-page booklet discusses the factors involved in the selection of a cleaner, cleaner equipment and compares the advantages offered by various types of cleaners commonly used in industrial cleaning procedures.

Acrylic Baking Enamel

Bee Chem. Co., Dept. MF, 2700 E. 170th St., Lansing, Ill.

A new brochure on Acrylador thermosetting acrylic finish for metals and thermosetting plastics, describes its properties and typical applications.

TAKE THE LOAD OFF YOUR TOP BRASS



USE TRUE BRITE BRASS SOLUTIONS

Trouble Free — Low Cost
Little Supervision Needed
Ready To Use — Just Add Water
Uniform Color — Can Match Colors

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Dual-Purpose Polishing and Buffing Wheels

Call for Formax Sisal Buffs when you have need for a fast cutting, heavy duty wheel to refine surface imperfections that are too deep for cloth buffs to remove. You will find they serve excellently to blend and smooth stretcher strains, orange peel, light die marks and polishing wheel grit lines. And—at the same time leave a bright surface finish.

Write for Descriptive Literature

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DETROIT 7, MICHIGAN
"THE FOUR McALEERS"

FORMAX ★ FORMAX ★ FORMAX ★ FORMAX ★ FORMAX ★ FORMAX ★

Formax Buffs manufactured in Canada by:
JOHN GALLOWAY, LTD., KITCHENER, ONTARIO

Hot Galvanizing

Hot Dip Galvanizers Assn., Dept. MF, 34 Berkeley Square, London, W. 1, England.

This publication, the second in a series of technical booklets to be issued by the Association, describes the hot galvanizing process and contains notes on the formation of alloy layers, spangle, corrosion resistance, fabricating and methods of finishing. It should prove to be of great value to technical students, engineers, architects and builders seeking basic information on galvanizing and its uses.

Fire Safety Equipment

Walter Kidde & Co., Inc., Dept. MF, 675 Main St., Belleville 9, N. J.

A new 12-page booklet illustrates and describes a full line of portable fire extinguishers, smoke and fire detectors, and built-in carbon dioxide systems.

Finishing Equipment & Supplies

J. Holland & Sons, Inc., Dept. MF, 200 Keap St., Brooklyn, N. Y.

A new catalog sheet lists the company's complete stock of plating, polishing and spray painting equipment and supplies. All items are listed alphabetically in the new literature which represents a handy guide for purchasing.

Infra-Red Ovens

Infra-Red Systems Inc., Dept. MF, 240 Route 23, Riverdale, N. J.

This bulletin considers the factors involved in designing ovens using gas and electric infra-red heat sources. It illustrates with sketches seven representative infra-red ovens and also lists a number of successful applications of infra-red heating.

Ultrasonic Cleaning

Blackstone, Corp., Dept. MF, 1111 Allen St., Jamestown, N. Y.

The above firm announces a series of new bulletins describing various models of ultrasonic cleaning systems.

Silicones in Industrial Finishes

Silicone Products Dept., General Electric Co., Dept. MF, Waterford, N. Y.

A new 16-page bulletin describes silicone-based industrial finishes and their capabilities. Designated CDS-294, the publication is liberally illustrated with both black and white and full color photos of comparative testing of silicone high temperature coatings and other coatings under a variety of test conditions as well as in actual applications. Included in the publication are discussions on range of colors available and information on applications.

Laboratory Instruments

Gardner Laboratory, Inc., Dept. MF, 5521 Landy Lane, Bethesda 14, Md.

A twenty-eight page illustrated catalog gives alphabetical listings including description, details and price of laboratory apparatus and scientific instruments.

Immersion Tin

MacDermid Inc., Dept. MF, Waterbury 20, Conn.

A new acid immersion tin plating process that produces a uniform corrosion-resistant deposit of tin on copper, copper alloys, lead, tin-lead alloys and solder is fully described in Technical Data Sheet No. 131.

STUTZ BALL ANODE CONTAINER

New Construction for longer Service . . .

STUTZ CONSTRUCTION

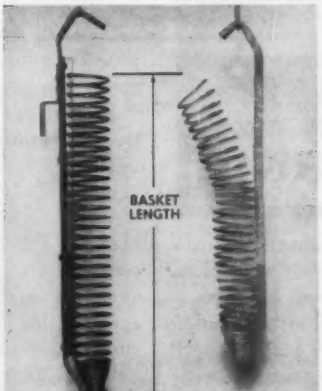
Heavy gauge steel with wire woven through steel angle firmly attached to main stem. Cannot come apart or loosen. Side clip is for STUTZ BARREL PLATING TANKS having submerged rectangular anode bars. Side clip not furnished for racked plating tanks unless specified. Standard hook 6 inches. Other hook lengths available, however deliveries could be delayed.

WELDED CONSTRUCTION

Note how welds have dissolved or broken in use. Often caused in barrel plating where currents are high and barrel transfer is rapid.

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STUTZ CONVENTIONAL



PRICES—12¢ per inch for basket lengths 18 inches or longer in increments of 3 inches. Side clips 25¢ extra. Shorter containers available at 18" price. Curved containers one size only, 27" for 14" and 16" diameter barrels 15¢ per basket additional.

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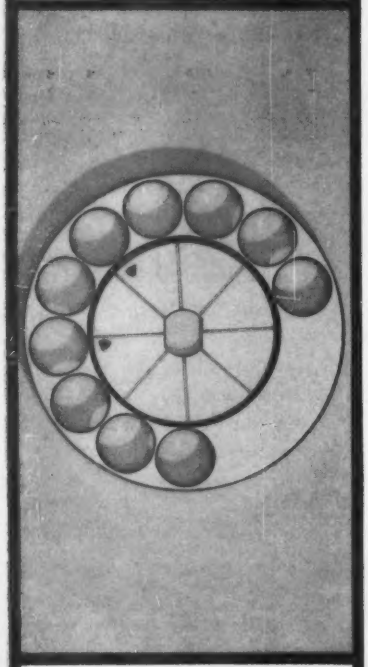
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The Problem:

■ To cut and color buff prior to chrome plate at minimum production speeds of 700 finished dials per hour... potential capability of 1,000 dials per hour to be available to meet future needs... finish to be free of imperfections despite irregular surface and thin edges... fixturing to be simple and maintenance-free.

Automatic Electric Put The Job On A Packer-Matic

For The Process see opposite page.

THE PACKER MACHINE COMPANY

456 Center Street
Meriden, Connecticut

Heating and Cooling

Dean Products, Inc., Dept. MF, 1042 Dean St., Brooklyn 38, N. Y.

Technical Data Bulletin No. 356 contains new and valuable information on heating, cooling and heat transfer; how to figure heating load, select heating surface; and pressure drop short cuts, together with sketches, photos, tables, graphs and problem solvers.

Industrial Gloves

Wilson Rubber Co., Industrial Div., 1200 Garfield Ave., S.W., Canton 6. Ohio.

A new full color, 20-page catalog illustrates the Wil-Gard line of protective gloves and finger cots, and reports the relative resistance ratings of glove materials to solutions commonly used in industry. Another chart offers a check on physical characteristics, such as tensile strength and heat resistance.

Specifications are listed for the approximate minimum thickness, length, weight, and size of each style, as well as its application to various industries and services.

Aluminum Conversion Coating

MacDermid Inc., Dept. MF, Waterbury 20, Conn.

Macro Alum. No. 5, a new method of producing a highly corrosion resistant coating on aluminum is fully described in Technical Data Sheet No. 87, a three-pager.

NEWS FROM CALIFORNIA



Hoffman Electronics Co. of Los Angeles has completed installation of a new research and development laboratory equipped for printed circuitry work and its applications. Among the facilities is equipment for research in contact printing, spray etching, and plating of gold, rhodium, tin, tin-lead, and stress-free nickel. A water system has been installed that assures purity of one part per million.

One of the functions of the new laboratory is to do research on copper-clad laminates and to determine for what they are most useful in electronics work. The laboratory staff will also engage in work aimed at pin-pointing surface contamination on printed circuit boards and to determine ways of eliminating such contaminants.

The new laboratory's research program will be conducted chiefly for the company but will also engage in some standardizing processing for outside vendors.

The plant, equipment and other assets of the Speed-D-Burr Corp., Wilmington, Calif., manufacturers of tumbling barrels and deburring machines, recently were acquired by the Coleman Engineering Co., Inc., of Los Angeles. The new owners have announced an expansion program which will double the 10,000 sq. ft. area of the Wilmington facilities into which the Coleman Co.'s engineering division will be moved from Torrance, Calif., about the first of the year.

Electrolab Printed Electronics Corp., a subsidiary of the Farrington Corp. of Los Angeles, has taken over the assets and business of the Sanford Process Co. of Los Angeles, developers of a process for hardcoating aluminum alloys.

Kaiser Aluminum & Chem. Corp. recently completed installation in its Trentwood, Wash., plant of a fully-automatic, specially-designed line for processing aluminum sheet and coil used in the manufacture of tin cans.

First of its kind in the United States, the stock finishing line, reportedly costing several million dollars, required two years for installation. The equipment is divided into three units for handling various processing steps. The complete set-up includes a degreasing and flattening line, a coating line, and a classifying line. Included are multi-story accumulators, tanks 28 feet deep holding 3900 gallons of degreasing solution, and electronic and X-ray controls.

The processing line has been planned to finish aluminum which has been hot and cold rolled to can stock gauges from large ingots cast in the Trentwood mill. The line is designed to inspect, clean, flatten coat, trim, shear and package the aluminum in coil and sheet form.

The degreasing and flattening line handles coiled aluminum strip in widths from 20 to 40 inches. Trim-

ming, cleaning, and leveling operations are performed in this 230-foot-long line. The degreasing and flattening unit is also equipped with shearing and welding devices which allow the end of the new coil to be attached to the end of the preceding one in an operation which takes about eleven seconds.

The third line includes a five-tank pre-treatment section in which the coiled aluminum strip is degreased, and facilities for applying an organic coating to one or both sides. A 180 foot oven, in which the coated strip is baked, is part of this line.

Research engineers of the Rohr Aircraft Corp. in Chula Vista, Calif., are reported to have developed a new chemical descaling technique which reduces surface attack on super alloys with savings in both cost and man-hours. Developed by *W. J. Wallace*, extended tests in the laboratory and plant reportedly have shown that the process adequately descales precipitation-hardened stainless steel in all conditions inherent in available acid descaling methods.

The process requires no heat and the use of chemicals is greatly reduced. It operates at room temperatures.

The American Society for Quality Control, San Bernardino, Calif., chapter, has elected as its 1961-62 president *Robert G. Derwent*, quality control engineer with Aerojet-General Corp., of Azusa, Calif.

R. M. Keil, Los Angeles district manager of the Dow Metal Products Division of Dow Chem. Co., has been transferred to Midland, Mich., as manager for magnesium products.

Consolidated Electrodynamics Corp., Pasadena, Calif., has announced appointment of *Daniel E. Murphy* as assistant to the president, and *Carlyle A. Mounteer* as assistant general manager of the Transducer Division.

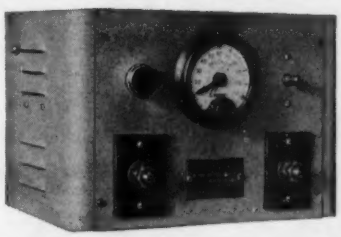
The Instrument Society of America, meeting at the Los Angeles Biltmore Hotel on Sept. 13 in conjunction with the society's 16th annual Instrument-Automation Conference and Exhibit, elected the following officers for the year 1961-62:

Phillip A. Sprague, Michigan City, Ind., (Hays Corp.) assumed the presidency after serving a year as president-elect-secretary. He succeeded *Dr. Ralph H. Tripp* of the Grumman Aircraft Engineering Corp., Bethpage, N. Y.

Nathan Cohn, president, Leeds & Northrup Co., Philadelphia, Pa., was named president-elect-secretary. Named as vice-president-elect of the standards and practices department was *John R. Mahoney*, superintendent of the Union Carbide Co.'s nuclear plant at Oak Ridge, Tenn. *Dr. Benjamin W. Thomas*, director of instrumentation physics research, Texas Butadiene & Chem. Corp., Baytown, Tex., was chosen vice president-elect of the society's technical department.

C. L. Alderuccio, technical service engineer of the Solvay Process Div., Allied Chem. Corp., Syracuse, N. Y., had a busy schedule during a mid-September visit to the West Coast. Working on a carefully meshed travel schedule and, thanks to the non-con-

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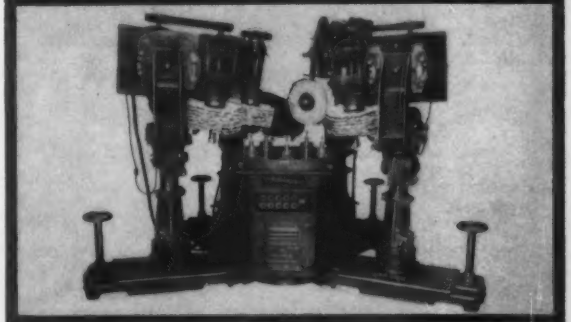
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flicting meeting dates of western branches of the A.E.S. he spoke to eight branches in an 11-day period His talk dealt with the adhesion of thick chromium deposits as affected by surface preparation.

Norris-Thermador, Inc., Vernon, Calif., has announced the appointment of *Ronald G. Lundeen* as general manager of its U.S. Porcelain Division.

NEW BOOK

Nickel-Chromium Plating

Published by Robert Draper Ltd., Kerbihan House, 85 Udney Park Road, Teddington, Middx., England. 1961. 140 pages, including index. Price: $3.75 postpaid.

This little book consists of four papers presented at a one-day symposium organized by the *Institute of Metal Finishing* in London last year. The subjects covered are recent developments in nickel plating, recent developments in decorative chromium plating, acceptance requirements for nickel-chromium plating, and meeting specifications in these finishes.

The volume will be of interest both to nickel-chromium platers who work to specification and to manufacturers who deal with contract shops, since the papers discuss the problems met, developments during the past decade in plating these metals, and testing from the point of view of the manufacturer.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

N. Y.-Newark Regional Meeting

New York Branch President *Jack Weiner* welcomed about 200 members and guests of both the New York and Newark branches to the third Metropolitan Regional Meeting at the Statler. He then introduced *John Trumbour* who is a member of both branches, and asked him to present the officers of both organizations. Most of the officers were present. Mr. Trumbour then presented *Justus Stremel*, founding father of the A.E.S. Mr. Stremel is planning retirement in the near future after 62 years service in the plating industry.

Committeemen of both branches had previously agreed that no business meeting would be held. In lieu of this, Librarian *Walter Schwartz* took over the main activity of the evening. He presented Mr. Kerr, whose topic was the "Finishing of Aluminum." Mr. Schwartz then presented Mr. Winters who spoke on "The Anode's Side of the Story." After a lively question and answer period, both speakers were given a rising vote of thanks. The meeting adjourned to partake of coffee, beer, cheese and crackers. This provided a very pleasant moment for members of both branches to renew old acquaintances.

Gustav Bittrich, Asst. Secretary

Southeastern Branch

The Branch held its first meeting of the season at the Pig-N-Whistle Restaurant, Atlanta, 8 September 1961, *Jerry LaChappelle* presiding.

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STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF METAL FINISHING, published monthly at New York, N. Y., for October 1, 1961.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Palmer H. Langdon, P. O. Box 48, Closter, N. J.; Editor, Nathaniel Hall, 40 E. 43rd St., Brooklyn 3, N. Y.; Managing editor, none; Business manager, John E. Trumbour, 57 Buena Vista Ave., Hawthorne, N. J.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address as well as that of each individual member, must be given.) Metals and Plastics Publications, Inc., 381 Broadway, Westwood, N. J.; Palmer H., Anne M. and Geoffrey M. Langdon, P. O. Box 48, Closter, N. J.; Louise L. Hasselback, Kaiserslautern, Germany; Joan T. Wiarda, 381 Broadway, Westwood, N. J.; John E. Trumbour, 57 Buena Vista Ave., Hawthorne, N. J.; Elizabeth Meyers, 285 Lafayette Ave., Hawthorne, N. J.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of the total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required by the act of June 11, 1960 to be included in all statement regardless of frequency of issue). 8,068.

JOHN E. TRUMBOUR, Business Mgr.

Sworn to and subscribed before me this 10th day of October, 1961.

GARRETT KNYFD

(Seal) (My commission expires July 19, 1966)

Bob Probert announced that the 4th Dixie Regional Technical Session was being put together by a most enthusiastic committee. Ten speakers and a plant tour and more for the ladies were news already promised from the committee. *Pat Millikin* forecast a good return from the printed program and Mr. LaChappelle assures that the meeting will be publicized widely in an effort to achieve a registration goal of 200 this year. *John Varner* will soon announce speakers.

After dinner Mr. Varner introduced the speaker for the evening, *Dr. Lloyd E. Parks* of the Bee Chem. Co., who sought to tie together the problems of the organic man and the metal plating man, stimulating very much interest, and practical discussion.

New members were announced: *Robert Neil Belcher*, Lockheed Aircraft, *Hugh N. Davis, Jr.* H. N. Davis & Co., Orlano, Fla. *H. M. Lissemore*, Turco Products, Inc.

Robert H. Probert, Asst. Secretary

Los Angeles Branch

An intensive drive has been launched to secure additional members in a number that will restore the branch to its position as one of the six largest in the Supreme Society. With *Harvey K. Hunt*, second vice-president, in charge, it was announced at the Sept. 13 meeting that a 9½ month membership campaign has been arranged, continuing through June 30, the end of the 1961-62 fiscal year. To inspire some additional effort and to reward those bringing in the most new members, a trio of prizes has been set up, for which all members of the branch, except the officers, are eligible. First prize is $50.00, second prize $25.00, third prize a year's dues ($15.00). The drive moved off to a good start on opening day when three new members were initiated and applications filed from six others.

New members initiated by President *Emmett H. Babcock* were *Dorothy N. Terrel*, *Bruce W. Wilson* and *Charles R. Thomas*. The applicants included *John H. Jones*, *G. R. Bowen*, *T. H. Allen*, *Harry G. Spatz*, *Milton Davis*, and *K. C. Wilmot*.

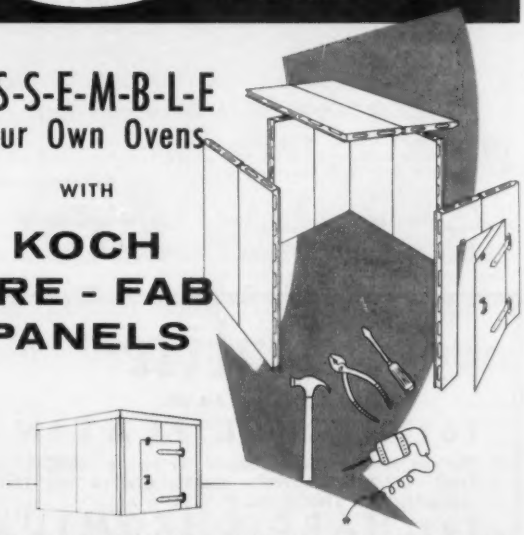
President Babcock gave a condensed report of the chief activities which took place at the recent Supreme Society convention. He also urged the members to hustle in their checks for 1961-62 dues, which, he said, must be paid by a certain date to meet the national office's earlier deadline for the per capita tax. The branch is anxious, Babcock announced, to avoid losses in money to the branch, which were not infrequent in the past when the Branch sent out per capita taxes for delinquent members who subsequently failed to pay their dues.

The speaker at the educational session was *C. L. Alderuccio*, technical service engineer, Solvay Process Div., Allied Chem. Corp., Syracuse, N. Y. His paper was entitled "The Adhesion of Thick Chromium Deposits as Affected by Surface Preparation," and included a discussion of a novel method for evaluating the adhesion of thicker electrodeposits.

The practicality of the non-conflicting meeting night schedules set up by western branches of the A.E.S. last year was demonstrated by Mr. Alderuccio's schedule, which enabled him to address eight branches in Arizona, California, Oregon, Washington, British Columbia, and Colorado in an all-day period between Sept. 11 and 22.

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Rockford Branch

The weather, while threatening, turned out to be ideally cool for the largest Plater's "Plae Dae" golf outing ever held by the Branch. 64 members and guests enjoyed the autumn sportiness of a very fine and challenging course at the Freeport Country Club in Freeport, Ill., with scores ranging from *Fritz Ludolph's* 78 (on a 70 par course) to a dubber's 142.

For the convenience of the golfers, and others, *Nick Servatius* sponsored and tended bar at a refreshment stand at the 15th hole, as part of the 25th anniversary celebration for Modern Plating Corp. which had held open house to the A.E.S. members and guests in the morning with kosher corned beef sandwiches and coffee for all who toured the 52,000 square feet of job plating facility in Freeport.

Following a superb buffet dinner in the new clubhouse, prizes for golf and attendance were distributed and the usual speeches and orations were heard. *Herman Tessman*, of the Milwaukee Branch, and general chairman of the 1962 convention to be held in that city, spoke briefly on convention plans. *Paul Glab*, Chicago Branch, and secretary of the Midwest Regional Council, told of the influx of registrations for the Third Technical Seminar to be held at Argonne National Laboratories on October 28th. *Rudy Hazuka*, president of the Chicago Branch, then announced the change of meeting place for his branch and invited all to attend their monthly meetings now being held at the Armour Research Institute in Chicago. Lastly, *Tom McCullough*, librarian, announced the programs for the early meetings of the society year which hold much promise.

Alexander Alexander, Publ. Chm.

Rochester Branch

The first meeting was started off with an excellent smorgasbord dinner at the Rochester Red Men's Club on Monday, Sept. 11. After the dinner, the meeting was called to order by President *Charles Fideor*, who introduced the guests of the evening. They were: *René Sonnenfeldt* and *Tom Kohler* of Sel Rex Corp., *Wm. Flynn* of Turco Products, *Joe Hwalek* of Sargent Greenleaf, and *John Moncine*.

Frank O. Beuckman reported on the A.S.M. course in electroplating that will again be given for interested persons, starting in February. He will explain the course in detail at the October meeting.

Sam D'Angelo, educatonal chairman, told about the program of the 1961-62 season. He gave each of the members a list of the speakers and their programs. The December meeting will be a panel discussion of "Problems in the Plating Room." A request of topics to be covered will be mailed to the members, and an appropriate panel of experts will be chosen to answer the questions submitted.

Charles Clark reported on the Chrstmas Party to be held Dec. 15th. This will either be preceded by a dinner or a smorgasbord after midnight.

A motion was carried that meetings for the coming season be held at the Rochester Red Men's Club on the first Monday of every month, with the exception of holidays, when it will be held on the second Monday.

Ray Berghold was reported to be seriously ill in the Highland Hospital.

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Mr. Berghold succumbed to his illness September 22nd. His passing will be a great loss to the Rochester Branch.

Peter VanDilst, Secretary

Phoenix Branch

The Sept. 11 meeting was held at Papago Lanes, Scottsdale, Ariz. After a roast beef dinner, *Jim Weaver*, president, opened the meeting. Five guests were welcomed; *Bud Traylor*, *Bob Baker*, *Del Bjork*, *John Hilton* and *George Wharmby*. The floor was opened to discussion of new business. First topic of discussion was the Christmas Party. The party committee is headed by *Floyd Huhn* and it was decided that the party was to be held the second Saturday in December.

A lengthy discussion was held concerning a changing of the regular meeting day from Tuesday to Monday due to possibility of speaker's schedule conflict brought on by the formation of the San Diego Branch and setting their meeting for Tuesday night. *Ron Dezember* made the motion that we continue our regular meeting time on the second Tuesday of the month until such time as is necessary to make a change. The motion was seconded and passed. At such a time as *Bill Bath*, educational chairman, finds it too difficult to obtain speakers for regular meetings, then discussion will be reopened concerning the changing of our meeting date.

The Ron's Club, through the efforts of *John Mullarkey* and *Floyd Huhn*, has been made available for meetings during the remainder of the year. A new membership application was received from *Willard Bell* of Chemresearch of Phoenix and Los Angeles. Membership was voted and approved by all.

The speaker for the evening was *Lee Alderuccio*, Allied Chemical Co. He was accompanied by *Ted Morgan* of the Los Angeles office. Mr. Alderuccio gave a very interesting talk concerning "Effect of Smear Layer On Adhesion Of Chrome Plate."

The meeting was attended by sixteen members and seven guests.

Ron Dezember, Secretary

Detroit Branch

The branch held its first meeting of the 1961-1962 season on September 8th, at the Statler Hilton Hotel at 8:00 P.M. The speaker was *William H. Jackson*, chief engineer of the Barrel Dept. of Udylite Corp., whose subject was "Barrel Plating Equipment and Processes Involved."

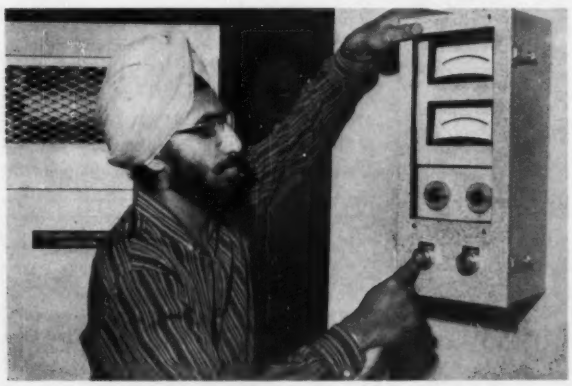
This opening meeting started the 50th Golden Anniversary year for the branch. The newly elected officers for this season are: President, *Edward Kubis*, Wyandotte Chem. Corp.; First Vice-President, *John Siefen*, Siefen Compound Inc.; Second Vice-President, *James Douglas Thomas*, Research Laboratories, General Motors Corp.; Secretary - Treasurer, *Guy A. Cummings*, Frederic B. Stevens Inc.

William P. Devan,
Public Relations Chairman

Hamilton Branch

The Branch opened its new season with a film night, Sept. 15, at 8:45 P.M. The meeting was held at Fischer's Hotel, with President *Bruce Connolly* in the chair. After a short business meeting Mr. Connolly turned the well-attended meeting over to *J. G. Needham*.

Mr. Needham introduced the two films which were on the Ransburg electrostatic coating process. Refresh-



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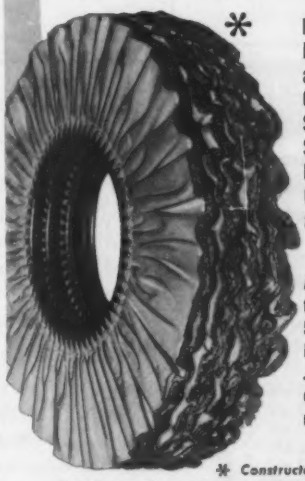


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ments were served and the meeting was adjourned at 11 P.M.

Officers for the 1961-1962 season are as follows:

President — *W. B. Connolly.*
Vice-president — *J. G. Needham.*
Librarian — *B. C. Teal.*
Treasurer — *W. Makison.*
Secretary — *D. J. Darby.*

Donald Darby, Secretary

Indianapolis Branch

The first meeting of the 1961-62 season was called to order by president *Robert Stewart*, following the usual dinner at the Construction League. The well-attended meeting started with the usual introduction of members and guests. The minutes of the last meeting were not read, due to the absence of the secretary.

Elmer Lundberg, *Bob Little*, and *Paul Freeman* volunteered to audit the books following the transfer of banking from Anderson to Indianapolis. *Quentin Shockley* reported that the arrangements for the branch to host the Supreme Society meeting Jan. 12, 1962 were progressing satisfactorily. *Ed Bruck* raised the question of inviting the Toledo branch into the Tri-State organization and discussion revealed that the time for action on this had passed. It was moved that branch delegates to the 1962 Interim and Milwaukee convention be appointed by President Stewart. This motion was carried unanimously and at least eight members indicated intentions of attending. Two new applications for membership were received and acknowledged.

Educational Chairman *Richard Watson* introduced *Marshal Whitehurst*, who gave a very interesting talk on how "electroless nickel" plating had been the answer to some difficult plating requirements at the R.C.A. plant in Indianapolis. This talk was the first of a series of short talks by local branch members as preludes to the regular guest speakers.

Following an announcement regarding next month's meeting and a plant tour of the Ford Motor Co. in Indianapolis, Mr. Watson introduced the guest speaker for the evening, *Joe Jackson*, of R. O. Hull Co., whose very capable presentation entitled "Practical Aspects of Zinc and Cadmium Plating," was very interesting and provided a better insight into some of the technical as well practical aspects of zinc and cadmium plating. The meeting was rounded out with a lively discussion period.

Les Reynolds, Acting Secretary

Columbus Branch

The branch met at the Desert Inn on Oct. 5. The proposed amendment to the Constitution that would eliminate the portion stating each member receives a copy of the Technical Proceedings was discussed.

James H. Peacock of the Duriron Co., Dayton, Ohio, was the guest speaker. His subject was "Metals and Plastics for Handling Plating Solutions." Mr. Peacock described and demonstrated with slides these nine forms of corrosion (1) general or uniform, (2) intergranular, (3) galvanic, (4) dezincification, (5) pitting, (6) concentration cell, (7) stress, (8) erosion, and (9) stray current attack. He then discussed materials that can be used for the various types of copper, chromium and nickel plating solutions.

Mary Fulmer, Branch Secretary

Dallas-Ft. Worth Branch

Chester Borlet, national president of the A.E.S., was the honored guest at the first fall meeting and annual banquet of the Branch. Some 100 members and guests enjoyed an elaborate Fellowship Hour, sponsored by local metal finishing concerns and suppliers, in the Embassy East Ballroom at the Statler Hilton in Dallas. Retiring Branch President *W. L. Aves, Jr.*, introduced Mr. Borlet, who spoke on "Highlights of A.E.S. Activities." Mr.



Chet Borlet, center, presents gavel to R. F. Howard as W. L. Aves looks on.

Borlet installed the following branch officers:

R. F. Howard — President.
D. L. Allie — 1st V.-P.
R. F. Walton — 2nd V.-P.
T. E. Betz — Secretary.
M. A. Davison — Treasurer.
D. Cox — Educational chairman.
E. W. Turns — Recording secretary.

President Howard thanked the Branch for its fine efforts in obtaining the 1967 National Convention for Dallas and the work done in A.E.S. Research Project #20. He called on *M. E. Browning*, co-chairman on Project #20, Vapor Deposition, to present the final check to *Dr. R. L. Hoyle*, research fellow on the project, for completion of Phase I.

D. L. "Don" Allie, committee chairman for the 1967 National Convention, discussed some timely aspects in-

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*3.6-5.0 pH	8.6-10.0 pH
*2.4-3.9 pH	10.1-11.3 pH
1.0-2.8 pH	10.5-13.0 pH
0.4-1.4 pH	11.0-13.1 pH

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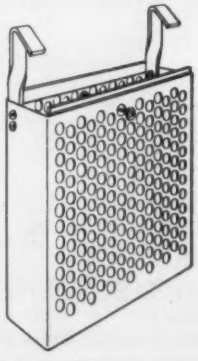
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IN STOCK

volved in this national venture. President Howard thanked the ladies and guests for their attendance and turned the meeting over to *Ted Betz*, banquet chairman, for the entertainment portion.

A very impressive Arthur Murray dance exhibition highlighted the entertainment program. The evening's activities concluded with dancing to the music of Ernie Shield's popular orchestra.

E. W. Turns, Recording Sec'y.

Chicago Branch

The first meeting of the 1961-62 season was held at the new meeting place, the Chemistry Building of Armour Research Foundation of Illinois Institute of Technology at 35th and Dearborn Sts. in Chicago.

One application for membership was turned over to the board of managers for approval. *Paul Glab* made a plea to the members to send a good-well card or visit *Lloyd Gilbertson*, a grand old-timer of the branch, at Dr. Busch Sanitarium, 170 Hemlock Ave. in Woodale, Ill. *Bill Geissman*, of the Rockford branch, made an announcement regarding their golf-outing to be held at Freeport, Ill., on Thursday, September 21, 1961. Dr. Monaweck urged members to send their reservations as early as possible for the Midwest Regional Conference to be held on Saturday, October 28, 1961, at Argonne National Laboratory in Lemont, Ill. *Rudy Hazucha* will appoint a committee of five members to make a report at the next meeting regarding the type of festivities for the annual "Ladies-Nite." A suggestion was made that those who have been members of the society for 25 years receive certificates from the National Society on the annual "Ladies-Nite." A motion was passed to support the Chicago Technical Society Council. The Council supports a youth program and a career conference for young students helping to choose a scientific career.

The guest speaker for the evening was *Kenneth Bellinger* of the Conversion Chemical Corp., whose subject was "Trouble Shooting in the Plating Room." A question and answer period followed.

Christopher Marzano, Publ. Chm.

Buffalo Branch

The Branch held its first meeting of the 1961-62 season Friday, Sept. 15 at the new meeting place, The Red Lobster, 2156 Sheridan Drive, Buffalo, N. Y. with 45 members and guests in attendance.

The Branch was honored to have in attendance the following officers of the Supreme Society: *Chester Borlet*, president, *Manuel Ben*, first vice-president, *Frank Beuckman*, second vice-president, *Edward Oberland*, third vice-president, *Dr. Andrew Wesley*, past president, and *John Nichols*, executive secretary. *Bert Kirchoff* introduced the Supreme officers.

President *John Donaldson* introduced the other guests of the evening *Carl McKetlie*, *Ray Sonnenfeldt*, *Tom Kohler*, *Tony Sojka*, *Bob Knoble*, and *John Killian*.

The following appointments were announced by the president: Christmas Party Committee, *Chuck Fotheringham* and *Jack Martin;* Technical Societies' Representative, *Matt Hayes;* Sick Committee, *Bert Kirchoff* and *Ray Kilroy;* Publicity Chairman, *John Tiebor*.

Following the business session, Educational Chairman *George Wolf* introduced the speaker of the evening. *Al Korbelak*, vice-president of marketing and new product development of the Sel-Rex Corp. whose topic was "Precious Metal Plating and Their Solderability."

Special prizes donated by *Mrs. Joan Wiarda* of METAL FINISHING and *Mr. Korbelak* were drawn for at the conclusion of the educational session.

The November meeting will be held Friday, November 3, 1961 at the Red Lobster. The Christmas Party will be held Saturday, December 2, 1961 at the Red Lobster and will take the place of the regular monthly meeting.

Robert C. Eich, Secretary

Blue Ridge Branch

The first monthly meeting of the 1961-62 fiscal year was held Sept. 8, at the Holliday Inn in Greensboro, N. C. Twenty-six members and guests attended. Branch president *Mike Milo* called the meeting to order and presided over the business session.

President Milo recognized the seven guests present, and then called the roll of officers. He announced the appointment of several committee chairmen. They are: *Howard Welfare*, *Gerri Lordi*, and *Roy Lewis*, branch district chairmen; *Dave Fineberg*, telephone committee chairman; *Grover Galloway*, sustaining membership chairman; and *George Lefevre*, fellowship chairman.

One new member was elected, *Albert K. Turton*, Westinghouse Electric Co., Raleigh, N. C.

After the business meeting those attending heard *Hugh Medford*, Western Electric Co., speak on "The Manufacture of Printed Circuits."

Donald H. McGee,
Secretary - Treasurer

New York Branch

The Third Metropolitan Regional Meeting was called to order at the Statler, on Sept. 22, by Pres. *Jack*

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Weiner of the New York Branch. There was an excellent turnout from the Newark and New York Branches. *John Trumbour* of METAL FINISHING introduced the officers of both branches.

All business was dispended with, and Mr. Weiner turned the meeting over to Librarian *Walter Schwartz* for the Educational Program. The first speaker was *Jack Kerr*, finishing engineer of Reynolds Metals Co. who spoke on "Finishes for Aluminum." The second speaker of the evening was *John B. Winters*, president and technical director of Incar, Inc. and past president of the Cleveland Branch. Mr. Winters' talk, The Anode's Side of The Story, went into electrochemical reactions, electrical and mechanical process of plating operations in relation to the anode.

After the question and answer period both speakers received a standing vote of thanks. The meeting was adjourned and the members retired to partake of foaming refreshment and exchange last summer's experiences.

Fred Saras, Recording Sec'y.

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METAL FINISHING SOCIETY OF JAPAN

The offices of the Metal Finishing Society of Japan have been moved to new quarters at Kyodo Bldg., 2, Iwamoto-cho, Chiyoda-ku, Tokyo. *Dr. Hiroshi Asada* is secretary of the society.

AMERICAN SOCIETY FOR TESTING AND MATERIALS

The name of the American Society for Testing Materials was officially changed to the American Society for Testing and Materials with the signing of a court decree on September 18, 1961, amending the Society's charter originally granted in 1902 by the Commonwealth of Pennsylvania.

The change in name was the result of study and discussion with members throughout the country extending over several years. It was also given careful consideration by the ASTM board of directors prior to its approval and adoption by the membership at the annual meeting, June, 1961.

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Nov. 27-Dec. 1: 28th Exposition, Chemical Industries, New York Coliseum, New York, N. Y.

Dec. 1-2: Annual Educational Meeting and Banquet, Detroit Branch A.E.S., Statler-Hilton Hotel, Detroit, Mich.

Dec. 15-16: Annual Educational Session and Banquet, Newark Branch AES, Robert Treat Hotel, Newark, N. J.

Jan. 13: 9th Interim Meeting, Supreme Society AES, Hotel Marott, Indianapolis, Ind.

Jan. 20: Annual Meeting, Grand Rapids Branch AES, Pantlind Hotel, Grand Rapids, Mich.

Jan. 27: Annual Educational Meeting and Banquet, Chicago Branch AES, Conrad Hilton Hotel, Chicago, Ill.

Jan. 30-Feb. 2: 18th Annual Technical Conference, Society of Plastics Engineers, Penn-Sheraton Hotel, Pittsburgh, Pa.

Feb. 6-7: Two-Day Symposium, ASTM, Statler-Hilton Hotel, Dallas, Texas.

Feb. 9-10: 4th Annual Educational Session, Dixie Regional AES, Dinkler-Plaza Hotel, Atlanta, Ga.

Feb. 17: Annual Technical Session and Banquet, New York Branch AES, Hotel Statler-Hilton, New York, N. Y.

Mar. 6-7: 5th Annual Technical Conference, Society of Vacuum Coaters, Sheraton-Cleveland Hotel, Cleveland, Ohio.

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18"	18"	18"	53"	39"	34"
20"	14"	36"	56"	44"	39"
24"	12"	12"	58"	22"	30"
24"	12"	24"	59"	42"	36"
24"	24"	36"	60"	18"	18"
26"	21"	23"	60"	21"	37"
27"	12"	37"	60"	36"	24"
28"	19"	23"	72"	18"	18"
29"	21"	24"	72"	23"	30"
30"	24"	30"	72"	35"	20"
30"	30"	30"	72"	42"	36"
30"	30"	36"	72"	48"	30"
31"	17"	17"	72"	48"	36"
36"	32"	42"	72"	60"	60"
36"	36"	42"	84"	12"	24"
38"	36"	30"	84"	20"	24"
40"	36"	36"	84"	25"	30"
42"	30"	48"	120"	36"	36"
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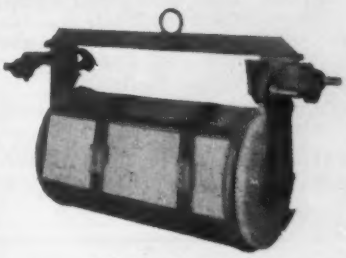
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1000/500	12/24	H-V-W
1500	15	Star
1500	30/50	Century
1500	40/65	G. E.
1500	65	Westinghouse
1500	70	Century
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6000/3000	6/12	Elec. Prod.
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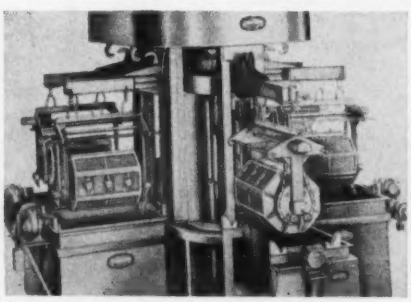
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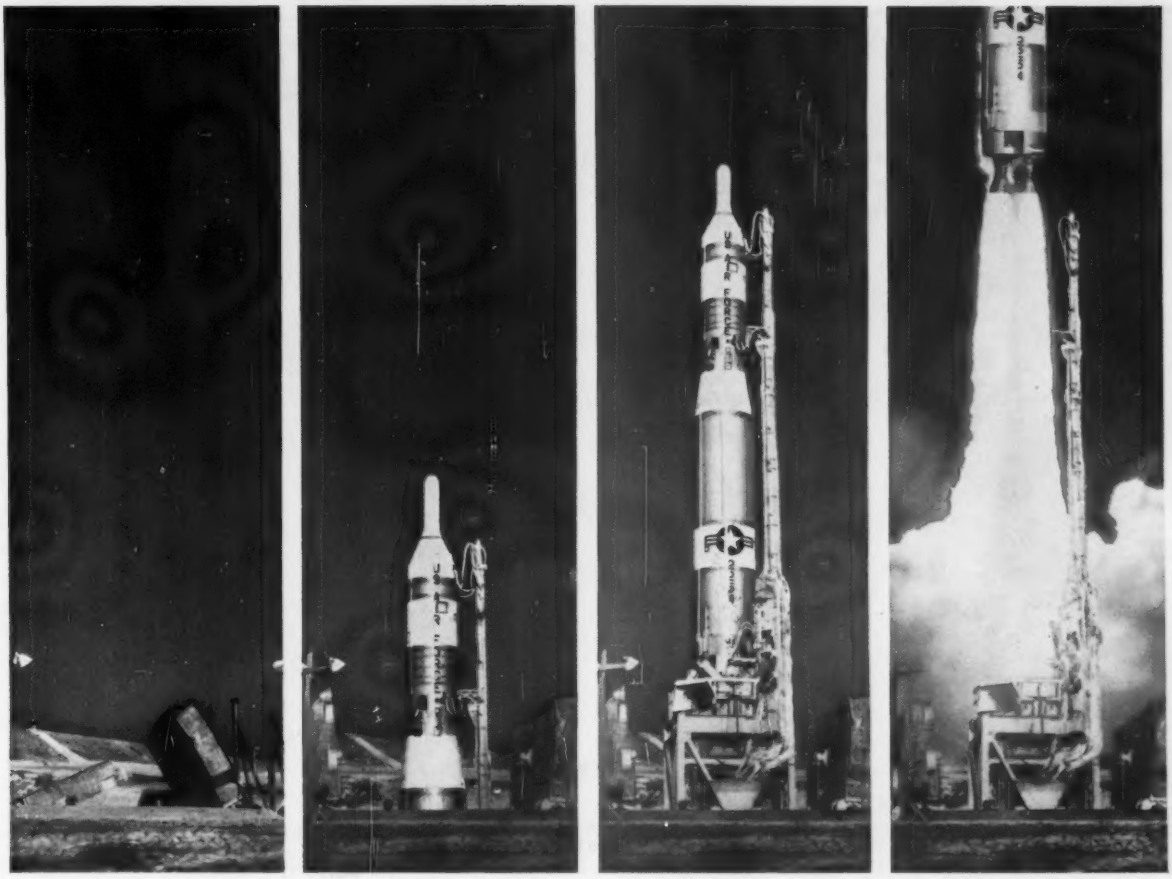
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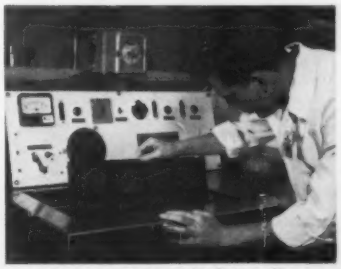
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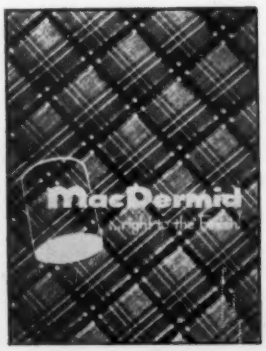
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